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Latest Developments in Airplane Design

A Review of Recent Developments in Airplane Construction and a Brief Survey of the Structural Materials Used in Building Airplanes

By JOHN F. HARDECKER, Chief Draftsman, Naval Aircraft Factory, Philadelphia, Pa.

THE airplane has always held the interest and aroused the imagination of every man of mechanical bent since that historic flight in a heavier-than-air machine by Orville Wright at Kitty Hawk, N. C., on the morning of December 17, 1903. Hardly any industry can point to such a remarkable record of practical achievement and development in a twenty-five year period as the aeronautical industry.

The airplane is a composite, fabricated structure employing the products and processes of many correlated industries, some of which at first glance appear quite remote from the production of aircraft. Born at the beginning of the world's greatest era of mechanical development, it has not been handicapped by tradition and prejudice. Taking the best and latest of the materials, processes, and equipment available in industry today, it has not only adapted them to its use, but it has in many instances advanced their development, and often made distinct contributions of its own. These contributions other industries have been quick to recognize and to adopt for their own use as well.

Developed and fostered in a mass production age, the aircraft industry was not unconscious of its needs in this respect even in its earlier periods; but its first and primary need was to convince a doubting world that the airplane is a safe, reliable, and adequate means of rapid transportation for passengers, mail, and express, and the earlier designers made this their objective. Hence design development, up until the last few years, centered about aerodynamical and technical development, until the historic flights of 1927 established conclusively that the objective had been attained. Thus we now find the industry with its technical case proved, ready to emerge from its era as a spectacular news headliner and to go to work as an established means of transportation.

While the primary purpose of this article is to review briefly present-day airplane design, it is necessary to digress for just a moment in order to establish the background for the remarkable design development that has taken place in the past year. At the beginning of 1928 the aircraft industry was controlled to a great extent by individual aeronautical pioneers, who in many instances were the sole owners of their companies. They recognized the need for a vast transformation in production methods, but they did not have the capital or resources to accomplish it. These early pioneers were not the only ones to realize this need, for the great mass of that intangible but powerful body generally spoken of as the "public" had also recognized it; and the public not only observed it, but forced the situation. At the end of 1928, therefore, the aeronautical industry was largely taken over by the public, under the control of various banking groups.

The pioneers are, of course, still leaders, but they have relinquished complete financial control. This transfer of control, coupled with the many mergers that have strengthened the industry, has been one of the most important things that could possibly happen to the industry, because it not only strengthened the financial position of the aircraft industry, but also definitely set the stage for mass production and mass production methods. Current design, therefore, from the very inception of a new plane, must be basically adapted to the possibility of mass production. A successful design should not have to be converted for production — its materials and fabrication processes must have been determined with this in mind from the very beginning. Airplanes are in the mass design era, and on the verge of mass production.

Fig. 1. (Upper View, Above) Sikorsky S-38 Amphibion Plane

Fig. 2. (Lower View, Above) Cessna Cantilever Cabin Monoplane, with Plywood Wings and Welded Steel Tubular Fuselage

Fig. 3. The Curtiss "Robin," a Monoplane of the Semi-cantilever Type, with Wings Made from Metal Ribs Mounted on Spruce Spars

Fig. 4. Gates-Day Model GD-24 Airplane Having a Fuselage Built Entirely of Open-section Extruded Duralumin Channel and Angle Shapes

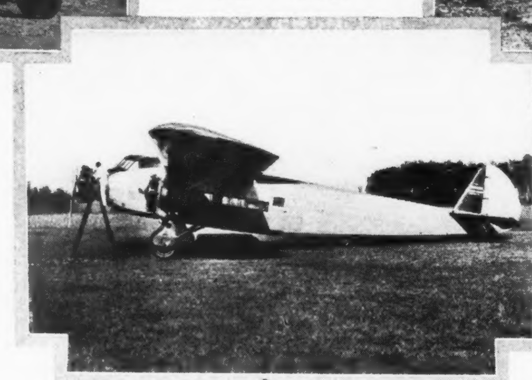


Fig. 5. The Keystone Patrician All-metal Twenty-passenger Three-engined Monoplane

Structural Materials Used in Airplanes

Wood, the pioneer structural material, still finds extensive application in aircraft design, particularly in wing construction; but despite its glorious past, and the fact that it will find a generous usage in airplane construction for many years to come, the history of automobile development has clearly demonstrated that metal is the predominant medium for mass production methods. The myth concerning the rapid exhaustion of our natural supply of suitable aeronautical timber has exploded, and there have been some very interesting new developments in wood fabrication; but the fact remains, that at present, metal is in the ascendancy.

Steel is a major material in airplane construction. In addition to its use in engine design, mild carbon steel (SAE 1025) has a liberal use in structural fittings, particularly when wood is used for the members. The need for higher strengths in order to minimize weight led to a rather liberal adoption of a heat-treated 3 1/2 per cent nickel alloy steel for structural use.

The current trend is toward chrome-molybdenum alloy steel (SAE 4130), which is rapidly replacing all other structural steels for aircraft use. Its use has made possible modern welded tubular steel fuselages, tail surfaces, and other units—the prevailing practice of today—because of its high strength after welding without any subsequent heat-treatment. The development of the technique of gas welding in the fabrication of aeronautical steel designs has been a distinct contribution of the aeronautical industry which has found its application in many other industries. Fabrication by welding in properly designed jigs is a development of the mass production idea.

Duralumin is the most important new alloy of all the aeronautical structural materials at present. It is a heat-treated aluminum-copper alloy with the strength of mild carbon steel at approximately half the weight. In the form of sheets, tubes, bars, rods, and castings its use is well established, but at present it must be fabricated by riveting, as duralumin welding has not yet become a successful production process.

Not only in its primary forms has duralumin been made applicable, but also in many other forms which have been developed for distinctly aeronautical production processes. In the form of stampings and pressings, made by a process in which

only one-half of the die is made of metal to act as a pattern, while the other half is merely a sheet of rubber which forces the sheet duralumin to take the form of the finished metal die, it has extensive application for wing ribs, bulkheads, wing beams, float parts, etc. As the standardization of wing curves, fuselage lines and float lines progresses, it is not unreasonable to assume that this process may lead to the development of a distinct field of specialized manufacture, serving the aircraft industry as a whole, and supplying such parts at very reasonable costs.

Bulb angle sections, made from sheet duralumin, and produced in quantity, have become available to the airplane industry during the past year. These sections possess inherent advantages which make them highly desirable for use in aeronautical design. Many sections peculiar to aircraft, such as the streamline section, have been drawn from duralumin and this has proved to be an excellent manufacturing procedure, particularly where the sections are thin. Standard structural shapes, such as angles, channels, tees, etc., paralleling the structural steel building shapes, have been made on the brake, and have had extensive application.

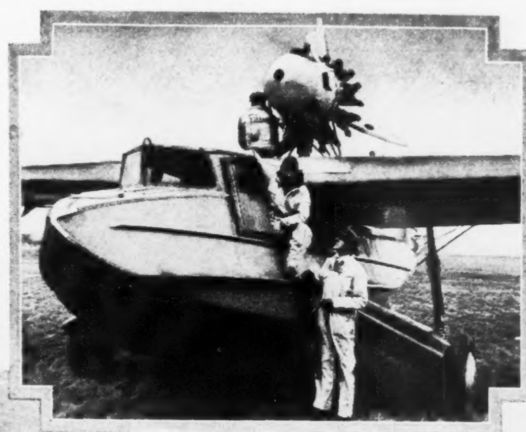


Fig. 6. (Above) One of the Latest Fokker Amphibian Planes

Fig. 9. (Below) Fokker Super-Triomotor F-10 Three-engined Plane which Carries Twelve to Fourteen Passengers and Two Pilots

Fig. 7. The Keystone Patrician in Flight

Fig. 8. Model 10 Sport-Waco Airplane

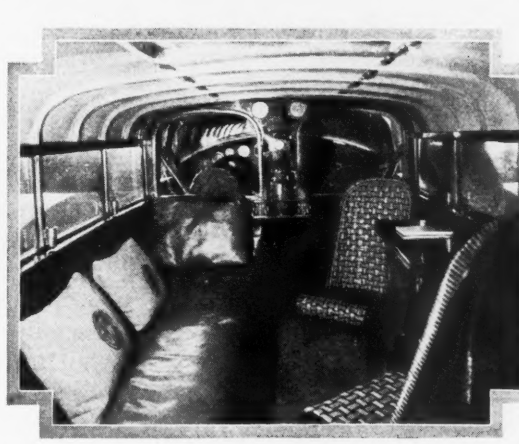


Fig. 10. Cabin Interior of a Sikorsky S-38 Amphibion Airplane. Several Planes with Interior Arrangements of This Type are Now in Service

The most recent development in duralumin shapes, and one that promises to exert a far-reaching influence in the trend of aeronautical development, has been the production of extruded duralumin shapes by production methods. Besides their obvious inherent advantage, they remove the difficulties incident to the thinning of the material at the bend when produced in the brake. These shapes, produced in all the standard shapes as well as in many peculiar to aeronautical fabrication, are being heralded as the forerunners of a new era in aeronautical construction. They are fabricated by duralumin rivets, which when heat-treated just prior to use are sufficiently soft for easy pointing; but the rivets subsequently age by air hardening and attain the same strength as the duralumin sections.

Aluminum, where strength is not a primary requisite, has an extensive use in airplane detail design, and is particularly applicable to tanks and cowling, for which purposes it can be readily welded. Owing to the need for extreme resistance to corrosion, particularly when operated along the sea coast, a special aluminum alloy, known as "Alclad," has been developed and is used extensively in hull construction for flying boats and amphibians, and for the construction of metal wing ribs. This material consists of heat-treated duralumin, coated with thin layers of high purity aluminum which is alloyed with the duralumin core. Monel metal is also being used in float construction. Copper and brass find their usual application in airplane details. In fact, many special alloys of all kinds are used in a manner paralleling the automotive field for many purposes too specialized to fall within the scope of this article.

A Few of the Latest Developments in Design Features

One of the outstanding features of current design is the refinement of detail required by actual or potential mass production methods. This applies both to the aerodynamical and performance features, as well as those tending to provide greater comfort and convenience for the passengers or pilot. These features tend

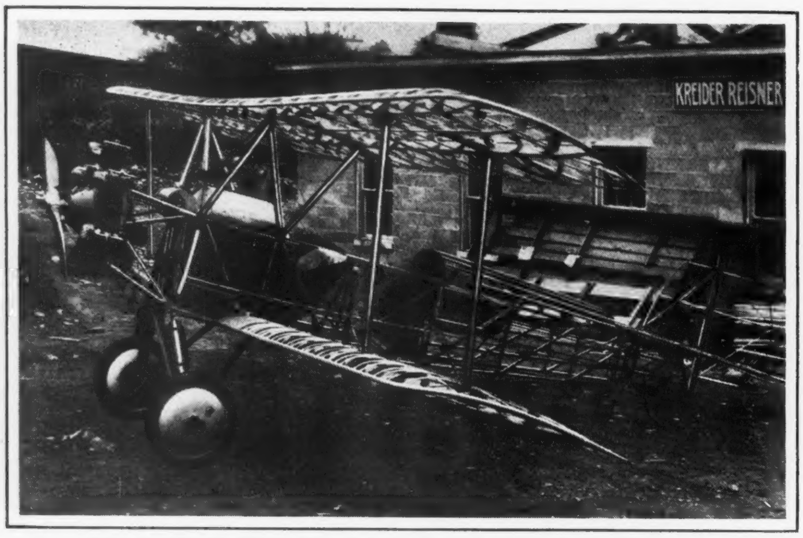


Fig. 11. The C-4 Challenger, Provided with a 150-Horsepower Engine, Showing the Large Use Made of Steel in Commercial Airplanes

to follow closely the trend of development in other fields, and while unusual in their aeronautical application, need not be discussed in detail. Of the strictly aeronautical development, only a brief resumé of some of the outstanding and unusual developments will be given.

One of the latest development achievements has been the work done by the National Advisory Committee for Aeronautics on cowling for radial engines. This cowling adds materially to the speed of planes powered with radial engines, and will also foster the development of twin-engined planes. It has already demonstrated its ability to increase the speed of one plane to which it was applied from 118 to 137 miles an hour. The use of brakes and tail-wheels is rapidly growing, not only in the heavy commercial planes, but also in the lighter commercial sport planes. The Handley-Page automatic wing slot, brought to this country and tried out on several different types of planes, has demonstrated its value in providing greater ease of control and safety of operation. Folding wings are used in an effort to take cognizance of the storage problem, and are making their appearance on a number of the newer planes. Oleo-pneumatic landing struts are another accepted feature.

Tapered wings are to be seen on a few of the newer models, particularly the "Sport Waco." This feature adds to the aerodynamic efficiency, but has previously been shunned because of the production complications involved. The amphibian flying boat has been greatly developed, and the application of retractable wheel landing gears to seaplane floats has also been marked. Visibility is coming in for greater consideration in the design of new planes, a feature that has too often been neglected in the past. Built-in fuel tanks, using the fuselage, hull, or float plating as an integral part of the tank structure, are also finding increased application. The latter feature is a considerable weight saver in the large planes. Indirect instrument

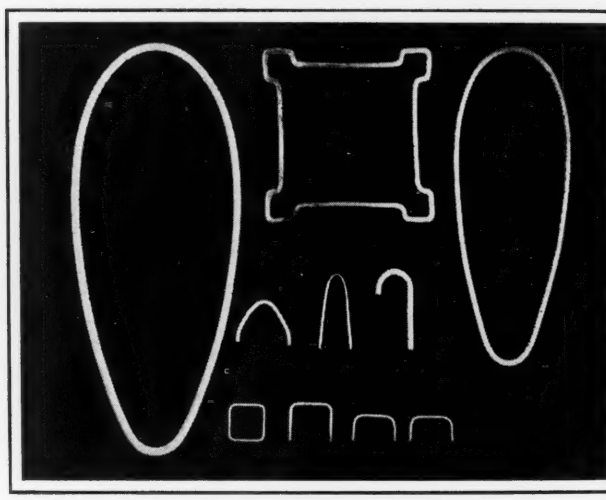


Fig. 13. Examples of Drawn Duralumin Shapes

lighting, similar to that used in automobile practice, is finding wide application in present-day airplane design.

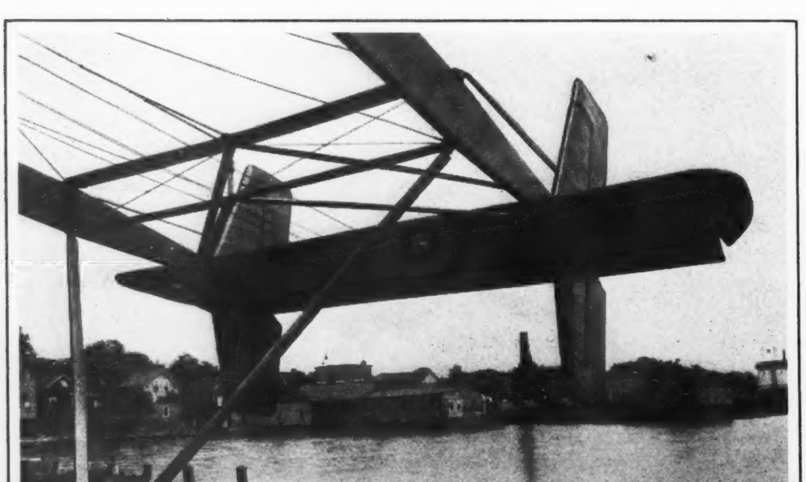


Fig. 12. Tail Unit of the Sikorsky S-38 Amphibion. The Vertical Rudders Located Directly in the Slip Stream of Each Engine are Self-compensating, thus Permitting Flight on One Engine without Pedal Adjustment

Types of Planes Indicative of Current Design

There is a growing tendency away from the "flivver" plane for the individual owner to the large transport plane in which the business man will travel in comfort and ease as a paying passenger. This tendency is exemplified in the combined transcontinental rail and plane service. This, however, is only a tendency, and we have at present a wide range of plane sizes now in production, from the single-seater to the twenty (or more) passenger type, with the predominant production still in the smaller plane class. To attempt to give even a brief description of all the current planes, with only a word or two concerning each, would be an almost impossible undertaking in a general article of this nature; so it should be distinctly borne

in mind that in selecting those that follow there is no intention to slight those that have been omitted.

The Advance Aircraft Co. has, perhaps, developed the mass production idea to its highest efficiency at the present time. The "Sport Waco" (Fig. 8), made by this company, is a very highly developed exemplification of just the type of plane its name implies. It is a production job throughout, and well illustrates the aerodynamical refinement possible at a reasonable price, with quantity straight-line production. The Curtiss-Robertson Co.'s new three-place "Robin" (Fig. 3) is a well engineered plane. It is a monoplane of the semi-cantilever type, with wing construction of Alclad metal ribs mounted on spruce spars and covered with fabric. The fuselage is constructed of chrome-molybdenum tubing, welded in the form of a Warren truss. The landing gear is of the split type and provides a wide spread to assure safe landing and easy "taxying." The tail skid is steerable to facilitate easy handling on the ground.

The new standard model GD-24 (Fig. 4) of the Gates-Day Aircraft Corporation has a very interesting fuselage, built entirely of open-section extruded duralumin channel and angle shapes. It is an excellent illustration of the simplicity that can be attained in well thought-out design, the entire fuselage structure being riveted and bolted together. The wings are tapered, both in plan and thickness, for about one-third the length. There are two gasoline tanks in the upper wing, and the plane has an adjustable stabilizer, steerable tail skid, and Oleo landing gear.

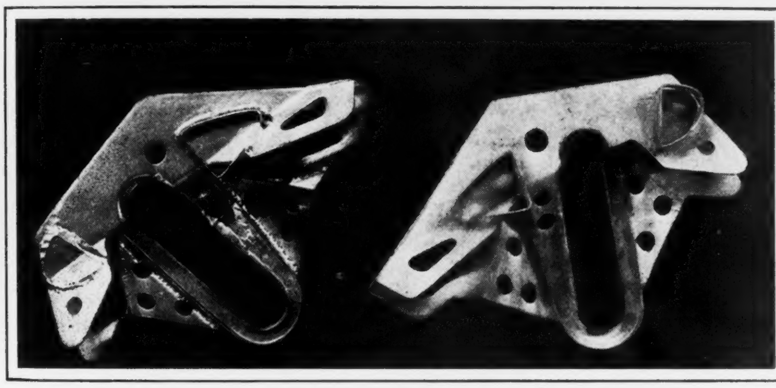


Fig. 14. Examples of Welded Aircraft Fittings

The Sikorsky S-38 Amphibion (Fig. 1) is a very good example of the high development of current large amphibian plane design. It is neither a monoplane nor a biplane, but with its wing and a half it is classed as a sesquiplane. These wings are of duralumin with fabric covering. The hull is of composite construction, the framework being of oak and ash, reinforced with duralumin plates and covered with heavy-gage, non-corrosive Alclad sheets. The retractable wheels, operated by hydraulic plungers, can be raised or lowered in less than fifty seconds. Luxurious interior accommodations are provided, as shown in Fig. 10.

Welded steel tubular construction, as applied to an all-steel plane, is exemplified in the Federal CM-3 plane, which has both fuselage and wings so constructed. The Federal Aircraft Corporation is an expansion of the Ryan Mechanics Monoplane Co.

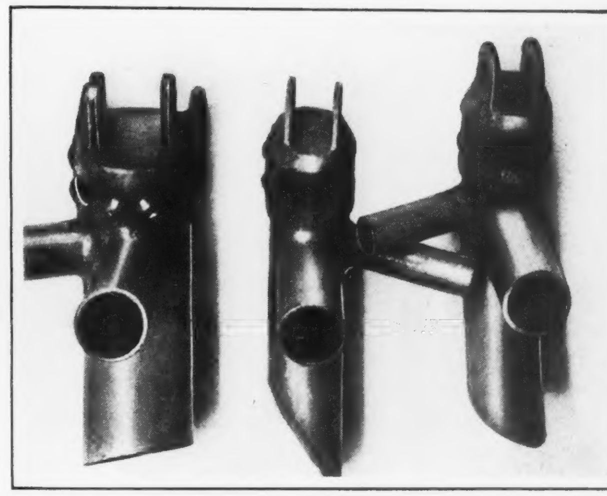


Fig. 15. Typical Welded Hinge Fittings

Particular attention has been given to economy of production, with the result that the same rib size is used all the way across, and the front and rear beams are interchangeable. The entire fuselage is assembled and welded on a master jig into the customary Warren truss structure, and uses no wire bracing. A detachable engine mount makes it practical to use any standard engine of suitable size.

The Krieder-Reisner C-4 Challenger (Fig. 11) is a good illustration of the large use made of steel in a representative small commercial plane of the open cockpit type. Chrome-molybdenum steel, welded for the most part, is used in the entire structure with the exception of the wing panels and turtle back. Even the control stick and the aileron torque tube are made from this class of steel by welding.

The Lockheed Vega monoplane represents the highest development of production methods in wood construction. Its fuselage and wings are built of molded spruce plywood, formed to shape in a cast concrete mold by the application of pressure by means of air in a restrained rubber air bag.

The Aristocrat, manufactured by the General Airplanes Corporation, has slotted ailerons and a cantilever landing gear. Each axle is supported on a single duralumin box member hinged to the lower longeron and extending upward into the fuselage with rubber disks at the upper end to

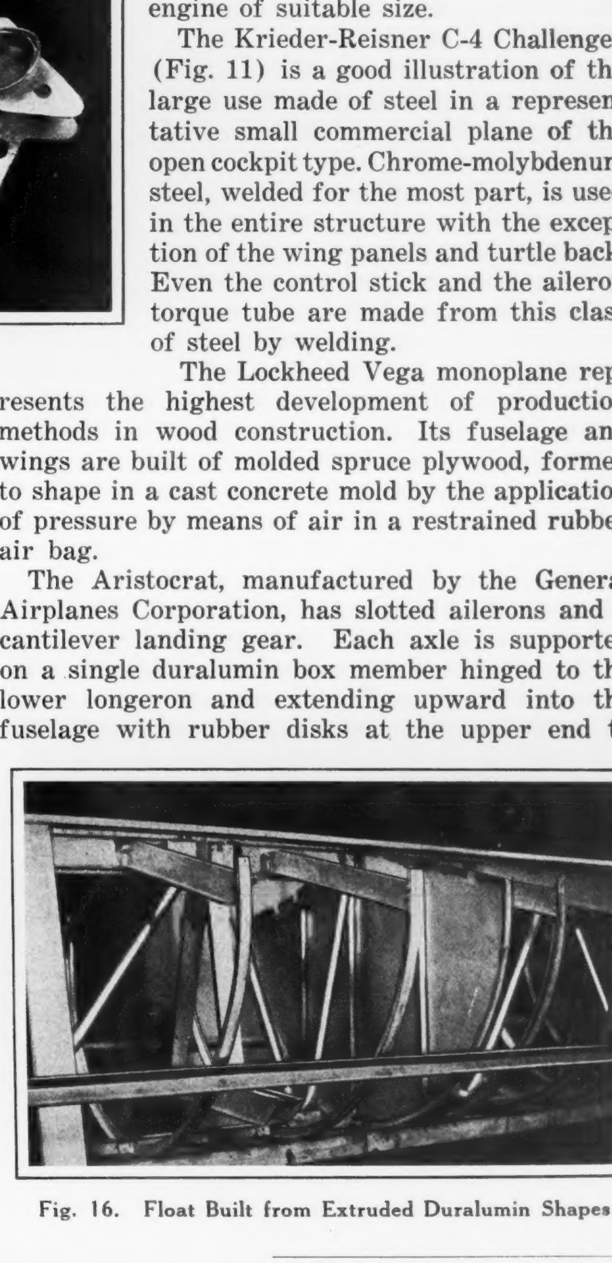


Fig. 16. Float Built from Extruded Duralumin Shapes

absorb the shock. The position of the shock absorbing mechanism within the fuselage produces a very compact landing gear and reduces air resistance.

The Fokker F-11 flying yacht is virtually a monoplane, with amphibian landing gear mounted in two lower wing stubs hinged to the side of the all-metal hull. The wing stubs also provide lateral stability when the craft is in the water. The engine is mounted in a streamline nacelle above the upper wing. In the interior, there is provision for a galley and sleeping compartment, in addition to the main salon and control compartment.

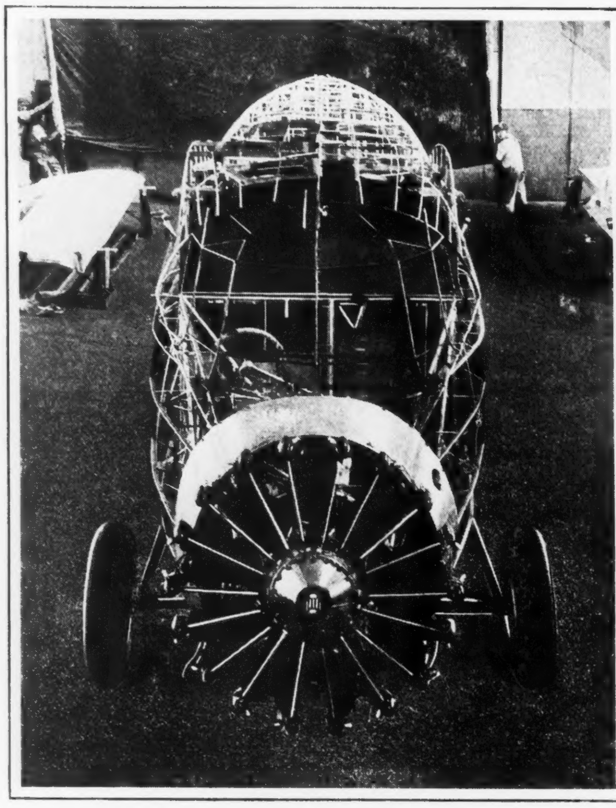


Fig. 17. Fuselage of Model 10 Sport-Waco

The Keystone Patrician (Figs. 5 and 7) is an all-metal twenty-passenger, three-engine monoplane. Fuselage, wing beams, and tail surfaces are of chrome-molybdenum steel tubing, with welded joints throughout. The ribs are of aluminum alloy, riveted in the form of a stiff truss. The ship will maintain flight with any one engine cut out, and will maintain a flat glide on a single engine, permitting an emergency landing to be made in safety. The landing gear is of the Oleo strut type, utilizing a combination of heavy steel springs and oil in enclosed cylinder blocks. Heavy ribbed aluminum fuel tanks, having a total capacity of 500 gallons, are located in the center section of the wing.

The Cessna cantilever cabin monoplane (Fig. 2) is a high-wing, full-cantilever monoplane with plywood wings and welded steel tubular fuselages. Owing to the absence of external bracing, the plane has very clean lines, with the pilot's cockpit faired in with a sort of cupola above it. This is transparent and, with the windows at the side of the fuselage, allows ample vision in all directions. Like most internally braced monoplane wings, the wing tapers in both chord and thickness. Pulleys are eliminated in the rudder control, reducing the chances of frayed edges.

The Fokker Super-Triomotor F-10 plane (Fig. 9) will carry twelve to fourteen passengers and two pilots. It is built to maintain a speed of 150 miles per hour. This plane has a separate compartment for baggage and mail, in addition to a lavatory. Its interior is especially luxurious, being fitted up in every way for the passengers' comfort.

Of major significance in the development and application of the mass production idea has been the standardization activity of the Army and Navy Standards Conference and the Society of Automotive Engineers. Not only has this activity produced standard specifications embodying the particular and exacting requirements of aeronautics for raw materials, thus making it possible to produce the highly specialized material desired in quantity at the metal mills, but it has also provided standardized designs, so that many small parts may be produced in quantity for the airplane market by specialized concerns. In many instances, basic installation dimensions for aircraft accessories have been agreed on so that the products of various accessory manufacturers might be used interchangeably. The value of this activity in the machine building and automotive industries has been kept constantly in mind, and it is indeed fortunate for the aircraft industry that this activity has been so well established at the inception of its entrance into the quantity production field.

In summing up, it may be pointed out that the aeronautical industry is in a healthy state. The engineering development is diverse and original, and in no way handicapped by the current standardization activities. The diversity of design now available is a direct indication of the sincere attempt made to design for specialized needs, rather than to force those needs to adapt themselves to the designs available. The entire industry has been practically refinanced on a sound basis, is well managed, and has a demand well in advance of the supply. The outlook for the future is indeed bright. Preliminary preparations have been made which assure the inauguration, in early summer, of many new transport lines, operating large passenger planes over regular air lines.

John F. Hardecker

JOHN F. HARDECKER, the author of this article, is well known to the aeronautical industry. He writes from a broad knowledge of the aeronautical field, gained through intimate contact with the industry in its various phases. He has been a contributor on technical engineering and production matters to all the leading aeronautical publications. Graduating from Cornell University with the degree of C.E. in 1917, he decided to cast his lot with the youthful aeronautical industry, which he firmly believed would become a commercial giant, and slowly but surely this transition is taking place. For over ten years, Mr. Hardecker has been associated with the Naval Aircraft Factory, located at Philadelphia, Pa., in executive engineering and production work, serving at the present time as chief draftsman of that organization. He is a member of the Society of Automotive Engineers' Standards Committee, Aeronautic Division, and for the last five years has been acting as one of the representatives of the Navy at the annual Army-Navy Aeronautical Conferences.

The Nitriding Process and its Advantages

A Recently Developed Method of Obtaining Surface Hardness on Alloy Steel Parts which may Supersede Ordinary Casehardening for Many Purposes

By J. L. HELQUIST, Tool Supervisor, Motor Apparatus Department,
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FINISHED steel parts can be given extremely hard and wear-resisting surfaces by the application of the nitriding process. These properties are obtained without changes in dimensions or warping, and the hardness, as well as other desirable characteristics, is retained at temperatures up to 1000 degrees F. Briefly, the process consists of subjecting the parts to be hardened to the action of ammonia gas while they are held at a high temperature. The period of time depends upon the depth of case desired.

This process of nitriding in dry ammonia is not really new, having been patented about 1914. However, it is only within the last few years that general interest has been shown in the possibilities of the process. It now promises to become a real competitor to casehardening with carbon. The nitriding process, as carried out at the plant of the Westinghouse Electric & Mfg. Co., will be described in this article.

What Steels Can Be Nitrided?

To obtain the best results from the nitriding process, it is necessary to use steels that favor the action of the ammonia gas. Plain carbon steels would not be included in such a list, but rather the more complex alloys of steel containing aluminum, molybdenum, chromium, and carbon.

Molybdenum-aluminum steels react most favorably to the process. Such steels, when nitrided, have proved especially suitable for use as dies in the production of aluminum die-castings. In this service, the high-temperature melted aluminum is forced into the molds under a high pressure and the action of the hot aluminum is hard on ordinary casehardened carbon steels. Usually, the dies become burned and defaced within a short time, and thus necessitate frequent redressings. Dies made from molybdenum-aluminum steel and nitrided, on the other hand, have been in such service for about a year during which they have produced thousands of die-castings. In a careful inspection of these dies, no indication could be found of their being burned or defaced. This steel, therefore, is recommended for that class of service.

Heat-treatment Preliminary to Nitriding

All work to be nitrided should be carefully annealed after the rough machining to remove internal strains and refine the grain. Additional heat-treatment is also possible where a tough core is desired. Parts must be carefully handled in these heat-treatments; otherwise, strains may be set up and the results of nitriding with regard to uniformity and dimensional conditions, will prove disappointing.

How the Nitriding Process is Carried out

Nitriding is done in a tightly sealed box or container. Ammonia is delivered to this container through a pipe which is connected to an ammonia tank and extends along the bottom of the container to the rear. An exit pipe for the ammonia is connected to the top of the box at the front and leads to a water seal. The top of the box is flanged to hold a loop made of 3/16-inch annealed nickel wire. A lid is clamped over this loop to make the box gastight.

The principal requirement of the furnace used for this process is uniform temperature over prolonged periods of time. Electric furnace equipment, in the opinion of the author, offers real advantages for this purpose and will be found most practical and economical, although gas or oil furnaces will also produce satisfactory results when carefully controlled.

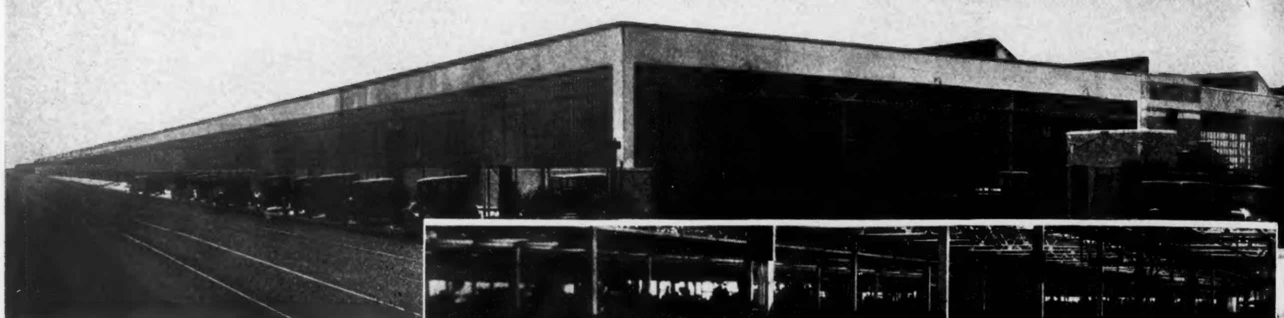
With the temperature control between 950 and 1000 degrees F., a practical minimum of time for the nitriding process is from fifteen to twenty hours for a depth of case of approximately 0.020 inch. This depth would be sufficient for the average class of work.

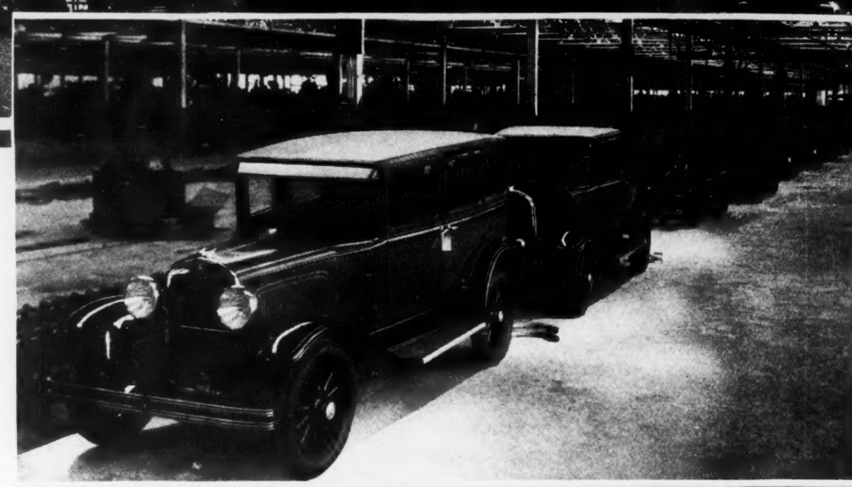
For the nitriding process, the finished parts are placed on perforated nickel shelves, being distributed as uniformly as possible. They must be free from grease, oil spots, washing compounds, and rust. After the cover has been clamped over the nickel wire gasket and all pipe connections made, the nitriding box is pushed into position in the furnace chamber. The furnace is then closed and the heat turned on. Ammonia gas is allowed to flow through the container while the box is heating up so as to expel all air and prevent superficial oxidation of the surfaces.

During the process, the temperature of the container is held close to 1000 degrees F., and this is checked by means of a thermo-couple within the box. The time of nitriding is directly proportional to the depth of case desired on the work. At the end of the heating period, the heat is shut off and the furnace is allowed to cool slowly, with the full flow of gas continuing until the temperature is lowered to approximately 500 degrees F. Then the furnace is opened, and the entrance and exit ammonia tubes are sealed tight. The box is allowed to cool in air to about the room temperature, after which it is opened and the charge withdrawn, this completing the operation.

In closing, it should be mentioned that it is not advisable to anneal a nitrided part, for the reason that the heat required to anneal the hard surfaces would practically destroy the desirable properties in the core or body of the part.

Eighty Days from Factory Foundation to Finished Cars





On October 10 the Chrysler Corporation Started a 300,000 Square-foot Factory for The Plymouth Car—The First Car Left the Assembly Line on December 28

QUICK decision and quick action have always been characteristic of the automobile industry. In no other field has such rapid progress been made in so comparatively short a span of years. The achievements of this industry have been due largely to the imagination and courage of the leaders in this field and to the ability of their engineers to complete a new project in a short space of time. New models have been brought out, new enterprises started, and new plants have been built almost over night. In the older industries that have adopted more settled and conservative policies, the feverish haste of the automobile industry has sometimes been looked upon questioningly, but the automobile industry has answered in a way that permits of no arguments. The success that it has achieved and the solid foundation upon which the leading automobile companies are built are proof of the soundness of the policies adopted.

The latest example of quick decision and immediate action in this field is furnished by the Chrysler Corporation in building and equipping an exceptionally modern plant in Detroit for the new Plymouth car. The story of this achievement is one of the finest examples of what can be accomplished in a brief period of time by sound business judgment and capable engineering talent, backed by ample financial resources.

On August 16 last year, Mr. Chrysler decided to build the new Plymouth car and to equip a plant for its production. In five days, complete cost estimates were prepared, covering a new building and machine tool and other plant equipment. On August 22 the appropriation for the new plant was made, and immediately an organization was gathered together, factory lay-outs were made, and building plans were completed. A modern shop built by Dodge Brothers, Inc., just previous to the

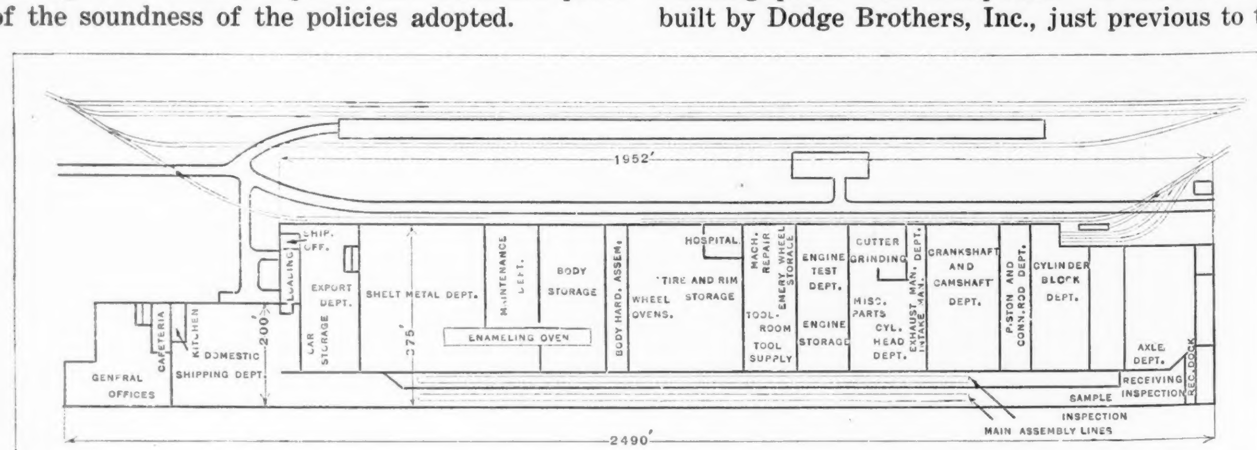


Fig. 1. Diagrammatical Plan of the Plymouth Plant of the Chrysler Corporation

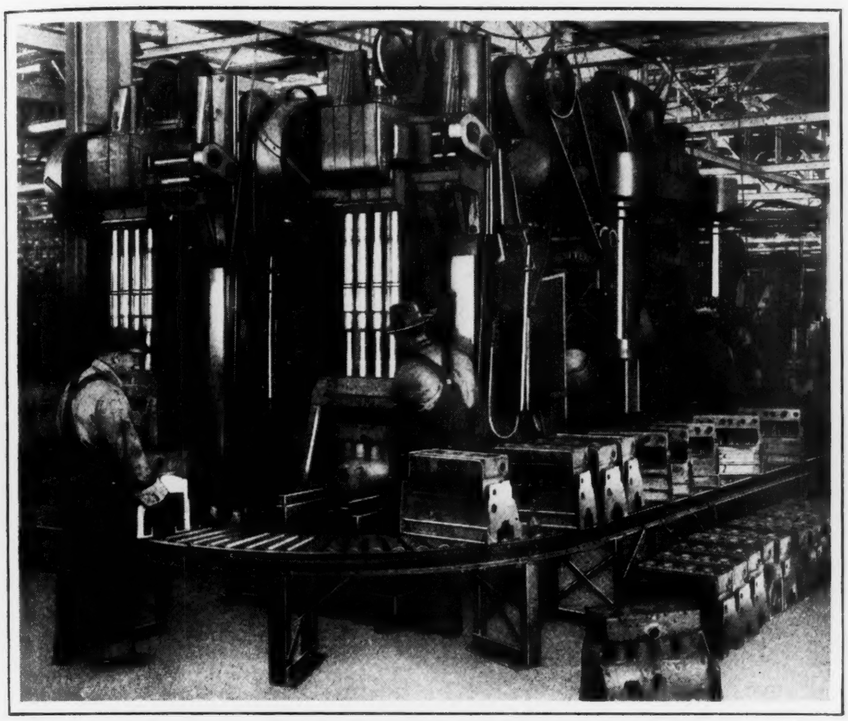


Fig. 2. A View in the Cylinder Boring Department

time when this company was merged with the Chrysler Corporation, was used as a nucleus. This plant was a one-story building, of sawtooth roof construction, approximately 1950 by 250 feet. To it was added a structure about 2500 feet long, 120 feet wide in one part and 200 feet wide in another.

Ground for the new factory was broken on October 10, and the building was completed and equipped so that the first cars left the assembly line on December 28, as shown in the insert in the heading illustration. At that time the assembly line conveyor system had not been completed, but within a month, two complete assembly line conveyors, about 1500 feet long, were installed.

In all, 2495 machine tools have been placed in operation in the plant. All these machines have individual motor drive, the motors varying from 1/4 to 100 horsepower. This equipment is sufficient for the production of 1000 cars a day, each of the two assembly lines having a capacity of 500 cars a day, or approximately one car a minute for each line during a nine-hour day.

The machine tools were installed by the end of the year, and by January 15 the entire plant was completed. In addition to the machine tool equipment, the complete plans for the plant included equipment for nickel, copper, chromium, and cadmium plating; an enameling plant of entirely new design built as an independent structure within the main plant; electric welding equipment; and numerous other accessories.

There is practically no trucking within the plant. Both raw materials and finished parts are moved to and from the operations on conveyors. In all, there are fourteen and one-half miles of conveyors. Practically the entire car, except the body, is built completely within the plant. Every part of the motor is made and assembled, as are also the axles, the four-wheel brakes, and the assembly of detail parts on the frames, the rough frame being obtained from an outside plant. The rough sheet-metal work is also obtained from the outside, but fenders, hoods, and similar parts, as well as the wheels, are finished within the plant. All wheel painting, enameling, and copper tubing work is done within the shop. In addition, of course, the complete power plant and the entire cars are assembled.

The plant is laid out with a view to eliminating all waste effort, and every operation that can be performed automatically is so handled. For example, in the plating and enameling installations, all the handling labor required is to hang the parts to be treated on the conveyors. From that moment on, the parts are automatically dipped in the tanks and passed in and out of the drying ovens without any manual labor.

The frames, without some of the brackets and other auxiliary parts, are delivered to the assembly line at one end of the shop, and from that moment on they are carried along conveyors until the entire car is assembled. The total time from the moment that the frame enters the assembly line until the completed car, with gasoline in the tank and a driver on the seat, leaves the assembly line, is 2 hours and 40 minutes.

Eight different models of the Plymouth car are built, but through variations in the painting and striping of the bodies, the types of wheels used, upholstering, etc., 250 different combinations are available. It takes about one hour from the time

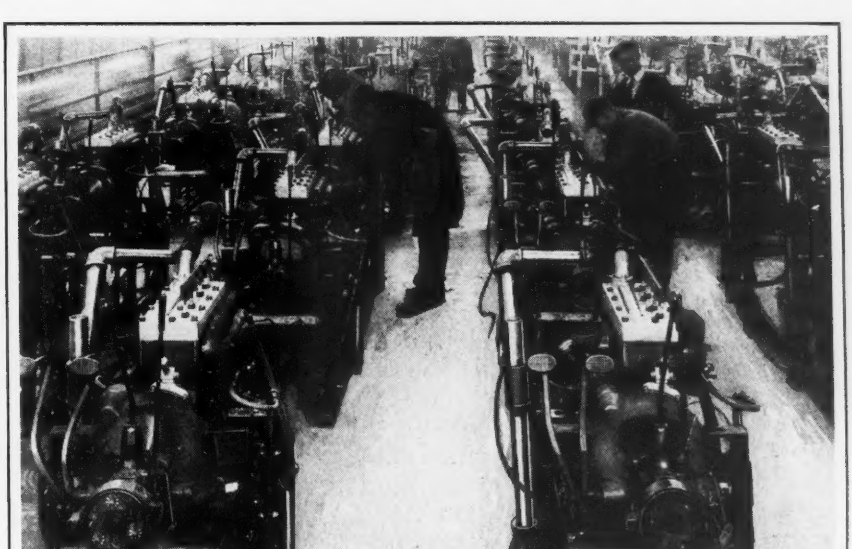


Fig. 3. The Motor Running-in Department, which has a Capacity for Running-in 200 Engines at Once

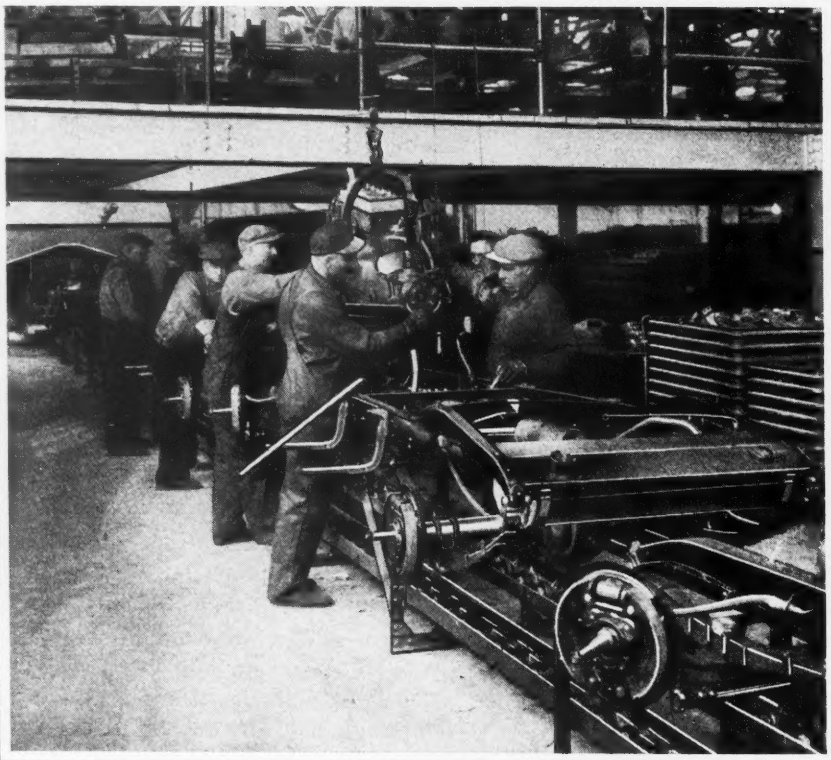


Fig. 4. Dropping the Motor into the Chassis while it is Moving Along the Assembly Line

that the wheels and bodies are placed on the chassis until the completely assembled, tested, and inspected car is ready for delivery, and it is literally possible for the sales department to ask a customer to sit down and wait for an hour while a special combination to his own specifications is assembled and made ready for him to drive away. Thus the speed and efficiency of building and equipping this plant has been carried right through the building and assembling of the product.

* * *

PLATINUM PRODUCTION

The production of platinum is still far below the pre-war level, when Russia mined all but a fraction of the world's output. During the war and until about 1924, Colombia succeeded Russia as the greatest producer of platinum, but in the last few years, the latter country has regained its leading position. However, both Canada and South Africa produce a considerable amount of platinum, and together add an appreciable percentage to the world's production. The United States production is a negligible factor. Before the war, Russia produced 250,000 ounces of platinum a year. This fell to 20,000 ounces in 1921, but has since that time increased until, in 1927, about 100,000 ounces was produced. Russia's production in the last few years has been greatly aided by the introduction of American electrically driven dredges.

PRECISION CYLINDRICAL GRINDING

At the Shop Practice Meeting in Chicago, mentioned on page 584 of April MACHINERY, R. E. W. Harrison, engineering director of the Cincinnati Grinders, Inc., Cincinnati, Ohio, reviewed, in a paper on "Precision Cylindrical Grinding," the process of evolution through which this branch of the grinding art has passed during the last seven or eight years. As the mechanical features of the machines and the wheels employed on them have been improved in efficiency, it has been realized that production is dependent upon the horsepower capacity of the machine; consequently, the structure of these machines has been strengthened and improved, until today they are offered to users largely on their power rating. Work which was regularly handled on 5-horsepower machines in 1920 and 1921, is today being produced in a proportionately reduced time on 15- and occasionally on 20-horsepower machines. A complete copy of the paper may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

* * *

The value of well lighted shops as a factor in reducing manufacturing costs deserves more attention than it usually receives.

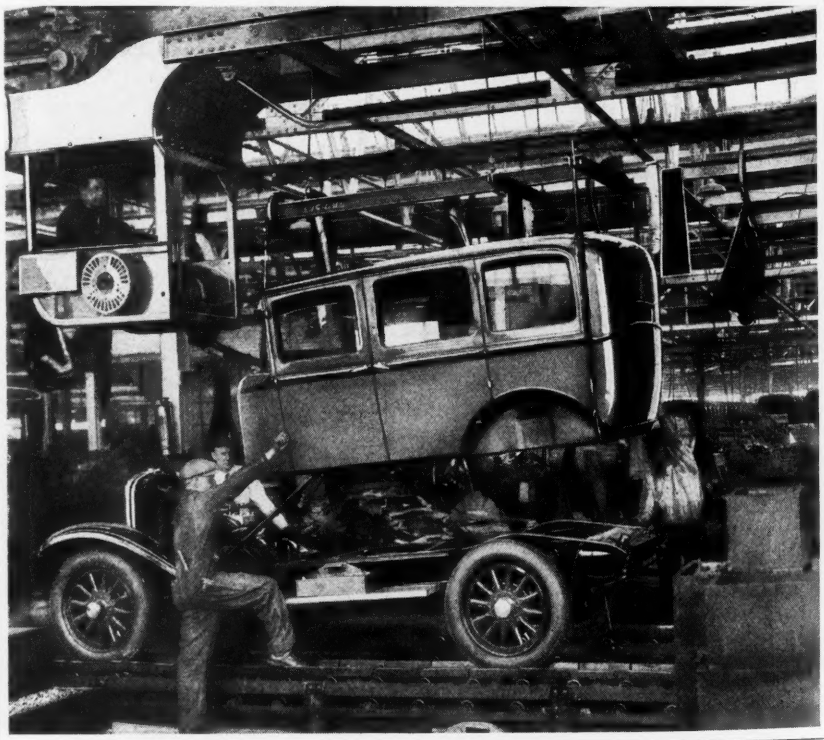


Fig. 5. Dropping the Body on the Chassis. This View Gives a Good Idea of the Overhead Conveyor System that Carries Fenders and All Other Parts About the Plant

CAUSES OF CHATTER IN GRINDING

Below is given a list of things that have actually been found to cause chatter in grinding, as published in *Grits and Grinds.*

1. Improper speed relation between wheel and work.

2. Improper use and an insufficient number of steadyrests. The stiffer the steadyrests are, the more rapidly will the work be done without chatter.

3. Vibration of steadyrest shoes because they are loose in the holders.

4. Uneven thickness of the belt driving the wheel or the work. More often the wheel belt causes trouble because of its uneven thickness. When a lump comes over the pulley, and sends the vibration out through the spindle to the wheel and thus to the work, and when a great many lumps in the belt keep doing this, considerable vibration is set up. The only remedy for this is to true the belt off to a uniform thickness, using a carpenter's chisel as a lathe tool, and rigging the belt up to run over a drum, passing the tool in front of it and making it of uniform thickness.

5. Poorly cut gears, unevenly spaced and rough on the face.

6. Improperly trued wheel.

7. Poorly fitted or loose centers.

8. Centers that are not round.

9. Centers in which the taper in the center hole is greater than the taper on the center point.

10. Centers not properly lubricated.

11. Poor fit of surfaces on wheel-slide, which is a result of wear caused by moving the wheel-slide back and forth in a small space on special work requiring only a short motion.

12. Attempt to force production on machines too light for the work being ground.

13. Irregular rotation of work or wheel, caused by loose belts, change in voltage or power, slipping of belts, etc.

14. A change in the surface of the wheel, such as glazing, or filling, which causes a different action of the wheel at different points on its cutting face.

15. Wheel out of round, caused by being brought up against the work without any lubricant on it, which breaks away the face.

16. Loose wheel-spindle.

17. Wheels out of balance, causing vibration all through the machine.

18. On crankshaft pin and bearing grinding, cheek of the crankshaft not being cleared away sufficiently to allow the wheel to pass by without touching it. This causes vibration of the wheel and work.

19. Too weak a driving pin, which will not allow the work to be revolved with a uniform motion.

20. Heavy and long revolving parts being out of running balance and running at high speed.

21. Work not tight on the centers.

22. Center points that are not true, and center holes that are not round.

23. Wheel loose on sleeve, causing it to slip.

24. End play in any revolving shaft running at high speed, which has collars on it that might knock against framework or bearings on the machine.

25. Motors used in connection with the machine, in which the armature is not in running balance, vibrations from which will cause marks on the work being ground.

* * *

FIFTY YEARS OF ELECTRIC LIGHT

This year marks the fiftieth anniversary of the invention of the first practical incandescent lamp by Thomas A. Edison. It is planned to celebrate the golden jubilee of the incandescent lamp in an appropriate manner, and several of the large electrical companies are expected to take part in this celebration. October 21, 1879, was the date when Mr. Edison first succeeded in producing a practical incandescent lamp, and that date this year will be set aside for the celebration.

In this connection it may be of interest to note that today it costs, with current at 7 cents per kilowatt-hour, approximately $7.35 (including the cost of the lamp) to light a room for 1000 hours with a 100-watt Mazda lamp. It would have cost $68.75 to light it as brilliantly with the original incandescent lamps, and approximately $1500 to obtain the same amount of light for the same length of time from candles.

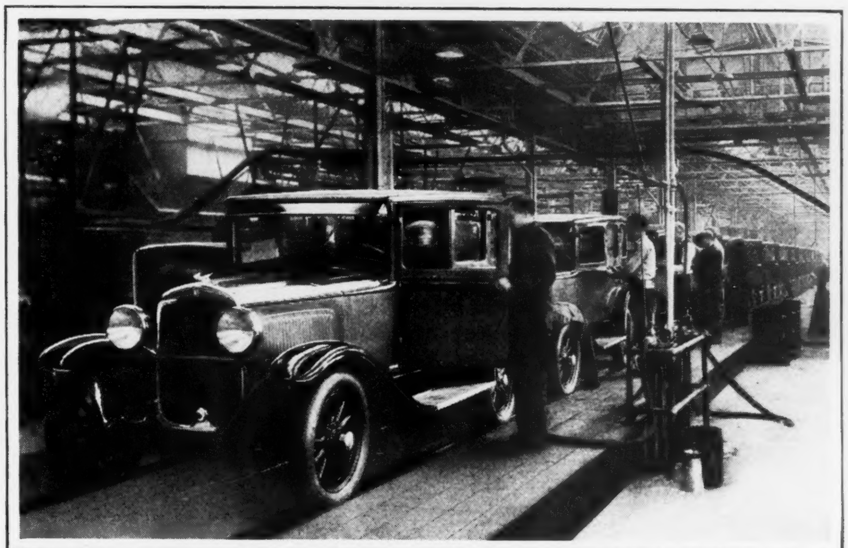


Fig. 6. The End of One Assembly Line. On the Opposite Side to the Right There is a Duplicate of This Line

* * *

Two new locomotives recently placed in operation by the Canadian Pacific Railway use a greater amount of alloy steel in their construction than any engines heretofore built. The wheel centers, pump brackets, guide yokes, piston-head centers, cross-head bodies, link support brackets, and many other parts are made from cast nickel steel. The use of alloy steel for these parts has permitted sections which previously were from 7/8 to 1 inch thick to be reduced to from 1/2 to 5/8 inch in thickness, without sacrifice of strength. The main- and side-rods and crankpins are made of low-carbon nickel steel. The engines weigh 423,000 pounds without tender.

What Causes Ball Bearing Troubles?

Most Troubles with Ball Bearings are Caused by not Following the Directions for Mounting and Care Given by the Manufacturer

By ASHER GOLDEN, R B F Ball Bearing Co., New York City

IN an article published in April MACHINERY, page 564, the author pointed out that the directions for mounting and applying ball bearings that are furnished by the bearing manufacturers are not as carefully studied and followed by users of bearings as they ought to be. In the present article, a number of alleged defects in ball bearings that the user believes to be the cause of his troubles are reviewed. In reality, there is not likely to be any defect in the bearing at all, but the trouble that the user believes to be caused by a defect is probably due to some fault in mounting the bearing or in giving it insufficient care. The complaints most frequently made and claimed to be due to bearing defects are as follows:

1. The hole is too large or too small.
2. The diameter of the outer ring is too large or too small.
3. In mounting the bearing, one of the rings cracked.
4. The bearing had a cracked ring when received.
5. The bearing has a broken ball.
6. The bearing is rough and noisy.
7. The bearing is loose.
8. The bearing is tight.
9. The bearing has a high spot.

The careful inspection of bearings before they leave the factories of leading makers makes it practically impossible that the defects claimed are present. It is the purpose of this article to show that the troubles arise in the mounting and use of the bearing. The statements here given are based on twenty years' experience with ball bearings.

When the Bore is Believed to Be Either too Large or too Small

There are numerous instances when users complain that the holes of bearings are either too large or too small. To the bearing manufacturer's suggestion that the shaft or spindle may be inaccurate, the answer usually is that the shaft has been measured and found to be all right. Now there are measurements and measurements, and it takes a great deal of care to measure even a shaft accurately, nor is one reading sufficient. The shaft may be elliptical, in which case the major axis may be greater than the nominal diameter of the shaft. This would make the bore of the bearing appear too small, and such a complaint is promptly made to the manufacturer.

Frequently the trouble is that the shaft is measured by inaccurate means or even by too crude methods to permit a precision measurement to be obtained; and if there is a discrepancy between the reading of the diameter of the shaft and the bore of the bearing, the immediate conclusion is that the bore in the bearing must be wrong, whereas there is every likelihood that this is not true.

The case referred to has to do with the application of a new bearing to a new spindle or shaft. Let us now see what may happen when a new bearing is applied to an old shaft. It may be well at this point to mention that while the previous remarks have had reference to the application of inner rings to shafts, they apply in principle with equal force to the application of the outer ring in the bore in which it is to fit.

In overhauling a machine, difficulty is sometimes experienced in removing the bearing from the shaft. The shaft may then have to be reduced in size to an extent sufficient to make the inner ring of a new bearing fit it loosely. This results in a complaint that the bore of the bearing is too great, but the bearing manufacturer is seldom informed of the real trouble, even when the user may know what it is.

What Causes the Bearing Surface of the Inner Ring to Run Loose on the Shaft?

We now come to an apparent defect that is quite common. A user returns a bearing that has been in use a week or two, claiming that it is defective. On examining the bearing, the surface of the inner ring that has been in contact with the shaft is found to be highly polished. Also, the sides of the inner ring adjacent to the flange against which the ring rests and the nut used to secure it are found to be polished.

When we find a bearing in this condition, there is no question about the way it has been functioning; either the inner ring was loosely (that is, improperly) fitted to begin with, or else some hard object—a small metal chip for example—has become lodged between the balls and the raceways. It may work its way out again, but if it does not, the bearing jams and locks and the shaft then rotates in the inner ring. The shaft is worn down and the inner ring becomes polished as a result of the rubbing.

Now it may happen that the inner ring is so tightly secured to the shaft that it cannot work loose. In that case, the shaft and the locked bearing turn as a unit in the housing and the outer ring becomes polished. Further, the inner ring may be so securely locked on the shaft and the outer ring so tightly fitted in the housing that neither of them can move. When this happens, something has to break. If the bearing itself breaks, the user believes that it is defective. If the shaft or housing should break, the blame is placed on the ball bearing.

Difficulty may be experienced in removing an old bearing because the shaft is burred and presents high spots that virtually increase the diameter of the shaft. When a bearing is forced over such high spots, the surface adjacent to the shaft will show

well defined marks—"mounting marks" the bearing manufacturer calls them—that run parallel to the axis of the bearing. In general, a bearing may be forced into place over these high spots without doing any damage to it.

Difficulty Experienced with Cracked Rings

From the time that the precision bearing came into use, bearing manufacturers have been educating users in the proper method of driving a bearing in place on a shaft. This educational process has been going on for more than twenty years; yet there are many mistakes still made in mounting bearings. Some machinists seem to have an idea that the inner ring should have a sliding fit on the shaft, while others believe that it is necessary to drive the ring in position with considerable force. The latter appear to outnumber the former.

The bearing manufacturer recommends that shafts be machined to certain diameters in order that the inner ring may have a proper fit. This fit is such that, in general, it should require no more than a few blows of a light hammer to drive the ring into place. Further, the user is cautioned to set the bearing squarely on the shaft and to drive it into position by means of a bronze or other soft metal tube placed against the face of the inner ring.

The machinist who does not appreciate the care that must be given ball bearings, when he finds that the bearing does not go on the shaft easily, is likely to seize a hammer—the heavier the better—and apply a heavy blow, first at one spot and then at another—usually on the inner ring, but sometimes on the outer. The tendency of the first blow is to cock the bearing. The second blow cocks it in another plane. The machinist continues to hammer away, and finding that he cannot drive the bearing into place, gives up the job and concludes that the hole in the bearing is too small.

In the vast majority of cases, however, when the bearing is treated in this manner, one ring or the other cracks and the bearing is pronounced defective. Bearings cracked in this manner are sometimes returned with the statement that the bearing was received in a cracked condition. Some time ago a small bearing was returned with the statement that the bearing was cracked in two places when it was received. Now a bearing with a ring cracked in more than one place could not be assembled. Small bearings have comparatively thin rings, and these are easily broken by improper mounting. Usually bearings that have been broken in this way bear telltale hammer marks on the side of the ring.

In a coming number of MACHINERY additional troubles with bearings, claimed to be due to defects, will be reviewed. The subjects to be taken up will be tight bearings, noisy bearings, broken balls, and loose bearings due to balls and retainers being attacked by free acid in the lubricant.

* * *

Engineers from every industrial nation in the world are expected to attend the Fourth International Management Congress to be held in Paris, France, June 19 to 23. Those interested may obtain further information from the American Management Association, 20 Vesey St., New York City.

SERVICE AND FAIR PLAY

By LESLIE CHILDS

When a machine builder places his product with a customer, he usually stands back of it in every sense of the word, and if it fails to perform according to contract, his service department is at the call of the customer without one penny of cost to the latter. However, there is a limit, both in business ethics and law, to the right of a customer to appeal to a seller's service department, and certainly this limit is reached when the faults to be remedied are caused by the customer's own negligence in operating a machine.

In one case of this kind, a machine builder sold a machine, and warranted its operation. However, it was clearly understood between the parties that certain gears demanded the use of light lubricants. The machine worked perfectly upon its installation and trial under the supervision of the seller's service department.

Some time after this, the customer sent in a hurry up call to the seller, stating that the gears heated up. A service man was immediately sent. and upon arrival found the only trouble to lie in the fact that the customer was using heavy grease in the gears. The matter was immediately remedied by substitution of the proper oil.

Following this, a mild controversy arose as to who should bear the cost of the service man's trip and work. The customer argued that he was entitled to this service; the seller contended that, since the expense was not caused by his fault, but solely through the neglect of the customer to use light oil, it was up to the latter to pay it. This particular case was amicably settled by the seller shouldering most of the bill, as frequently happens in situations of this kind. But let us examine the merits of the case.

Under the facts, there is little doubt of the customer's legal liability for the service man's time. Certainly, the seller's guarantee did not cover breakdowns caused solely by the customer's negligence in operating the machine. But there is a larger, and by far more important question involved, which has nothing to do with law. Fair play and business ethics required that the customer bear this expense. He was solely to blame, and his insistence on the seller bearing part of the cost constituted a species of trade coercion that cannot be defended.

In situations of this kind, both customers and sellers may well remember that a chain is no stronger than its weakest link; that they are engaged in the same line of industry, and are mutually dependent upon each other; and that the continued success and prosperity of any industry depends in a great measure on its ethical pitch on the plane of contact. The customer may have temporarily gained a few dollars in this case at the expense of the seller; but gains grounded on acts that fracture moral obligations are, under economic laws, eventually charged to the industry involved. So that, in the long run, this customer will no doubt be called upon to make restitution for the injustice in the form of higher prices for equipment or service.

Horizontal Boring Machine of Mammoth Size

An Exceptionally Large Boring Machine of German Design Built for Machining Steam Turbine Housings and Rotors for Large Power Plants

By S. WEIL, Chief Engineer, Schiess-Defries A. G., Dusseldorf, Germany

THE boring machines shown in the accompanying illustrations were built by Schiess-Defries, A. G., Düsseldorf, Germany, for machining casings for ocean liner steam turbines and for turbines and generators for large electric power stations. These machines have a capacity for boring turbine housings up to 18 feet in diameter, and are equipped with horizontal boring-bars which can be adjusted vertically. The strongly constructed pillars which carry the vertically adjustable headstocks can be traversed along the heavy bedplates.

The boring-bars are attached to geared faceplates on the headstock spindles. When one of these machines is in operation, the boring-bar, together with the headstock and pillar, is power-fed along the bedplate, the boring-bar tool first being traversed through the turbine housings to be machined. Steadyrests support the bar at its outer or free end.

The machine shown in Fig. 1 is the earlier of the two machines illustrated, the machine shown in Fig. 3 being the latest of the type described. In Fig. 2 is shown the control side of the machine illustrated in Fig. 3. The machine is shown in Fig. 3 boring the housing for a 160,000-kilowatt turbo-generator for the Hell Gate Power Station in New York. This generator was built by Brown, Boveri & Co., Baden, Switzerland.

The Driving Motor and its Controls

The power is supplied by an electric motor of 55 horsepower, mounted at the rear of the pillar. A reduction gear enables the faceplate to be run at a speed of from 0.3 to 30 revolutions per minute. The motor is operated by push-button control, panels being provided on the headstock and base of the pillar. Two other panels attached to flexible cables are provided, one being mounted on the pillar side and one on the free end side of the boring-bar. These control panels enable the operator to manipulate the machine from any point, even from the interior of the work. The rest of the electrical equipment is encased in the interior of the pillar.

Both the vertical electric traverse of the headstock and the horizontal quick traverse of the pillar along the bedplate are operated by power, the final adjustment being by hand. A variable power-operated feed is provided for the machining cuts. Limit switches at the extreme traversing positions of the sliding parts prevent damage such as might otherwise occur through the inattention of the operator. An accurately graduated scale with a

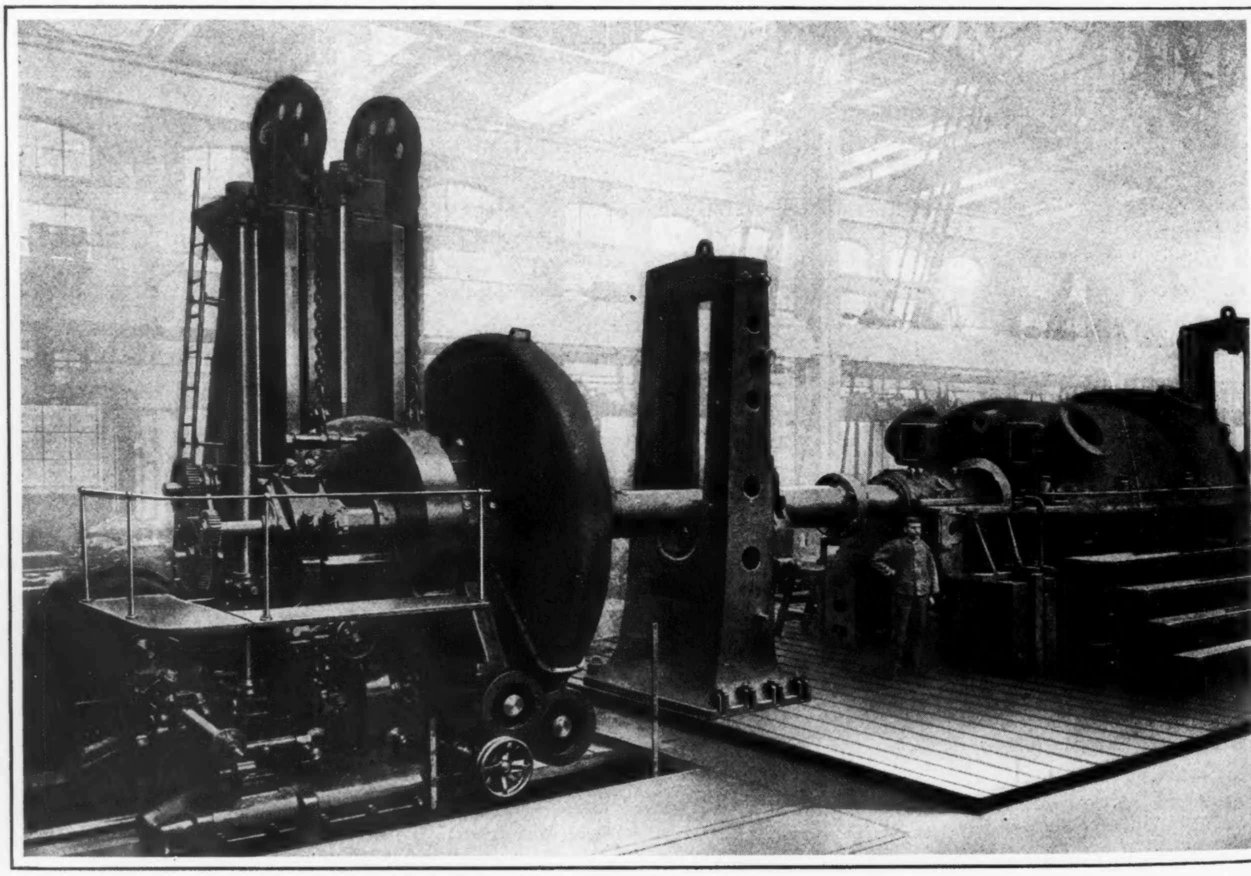


Fig. 1. Cylinder Boring Machine Set up for Boring Turbine Casing

vernier inserted in the bedplate enables the pillar to be accurately located in any desired position. Locking devices are provided for all gears, which make it impossible to engage interfering gear mechanisms at the same time.

Power-driven oil-pressure pumps from a central station provide automatic lubrication. The flow of oil to each bearing may be watched through conveniently located sight-feeds, and properly regulated by means of individual adjustments. There are eighty-five points to which lubricant is supplied.

Multi-tool heads attached to the boring-bar are employed for machining cylindrical and conical bores, as well as for cutting grooves for the mounting of turbine blades. Facing tool-rests fastened to the boring-bar enable the cutters to be set correctly for any diameter of bore. These tool-rests are also used for grooving operations. In machining taper bores, the cutting tool is fed in the required direction by the accurately timed horizontal and radial feeding movements obtained through change-gear wheels.

Some of the principal dimensions of the large boring machines described are as follows: Maximum height of headstock spindle center above bedplate, 11 1/2 feet; length of vertical

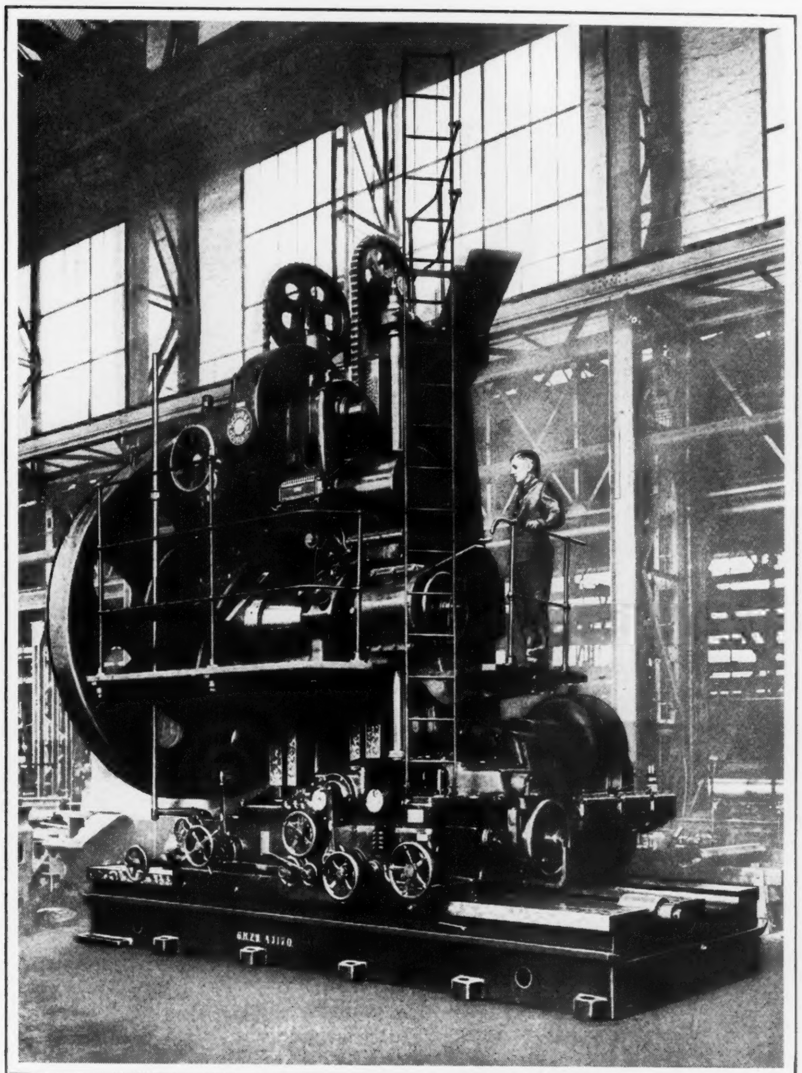


Fig. 2. Control Side of the Large Horizontal Boring Machine Shown Below. This Machine will Bore Holes Thirteen Feet in Diameter

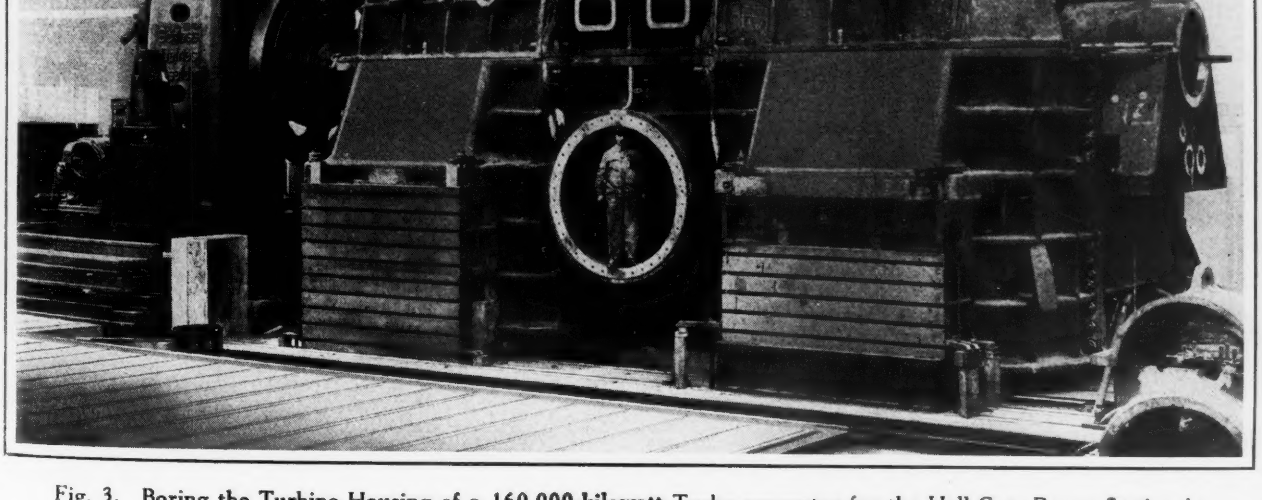


Fig. 3. Boring the Turbine Housing of a 160,000-kilowatt Turbo-generator for the Hell Gate Power Station in New York, at the Plant of Brown, Boveri & Co. at Baden, Switzerland

travel of headstock, 51 inches; horizontal traverse of pillar along bedplate, 8 feet 2 1/2 inches; maximum bore to be machined, 13 feet; maximum capacity for facing, 18 feet in diameter; maximum diameter of boring-bar, 23 1/2 inches; length of bedplate, 46 feet; width of bedplate, 26 1/4 feet. The machine, including the bedplate, weighs 240 tons.

* * *

GOVERNMENT AIRPLANE ENGINE TESTS

The Bureau of Standards began testing new commercial airplane engines, as a basis for granting approved type certificates by the Aeronautics Branch of the Department of Commerce, in March, 1928. The certificate authorizes the use, in licensed aircraft, of any engine conforming to the specifications of the engine submitted, and specifies the speed and power rating of the engine. According to *Automotive Industries*, twenty-one type tests have so far been undertaken at the Bureau, and of this number four engines have been withdrawn, eleven have failed, and six have completed the test successfully. The results show that the average manufacturer should do more development work before going into production, and indicate the importance of type testing as a protection to the public.

The following engines have been approved and rated as a result of type tests at this Bureau: Kinner, Velie, Comet, Axelson, LeBlond, and Harris. The Warner "Scarab" engine was approved before the present regulations went into effect. Thirteen other engines, including, for example, the Curtiss "Challenger," the Wright "Whirlwind," and the Pratt & Whitney "Wasp" have been approved on the basis of Army or Navy tests and have received commercial ratings recommended by the Bureau.

The number of airplane engines intended primarily for commercial use which are under development at the present time exceeds all estimates.

* * *

GERMAN MACHINERY EXPORTS

The exports of machinery from Germany passed those of Great Britain in the early part of 1927, and Germany now ranks second among the machinery exporting countries of the world, being surpassed only by the United States. German exports of industrial machinery during the first nine months of 1928 amounted to $163,000,000. There is no separate division for machine tools or metal-working machinery, but the value of all machines exported for the working of metal, wood or stone exceeded $30,000,000. The markets were chiefly Soviet Russia, Argentina, Brazil, Great Britain, Czecho-Slovakia, and Poland.

Heavy Machinery Built by Production Methods

Very large and heavy machinery is used in modern sugar mills. Such mills are capable of crushing more than 5000 tons of sugar cane per day. The crushing rolls used in machines of this kind require some very interesting machining operations, and because a comparatively small number of these heavy mills are built, it is not possible to put them through in quantity, the same as smaller machines for which there is a greater demand. Nevertheless, one plant engaged in building sugar mill machinery has carefully studied its problems, and produces this equipment by methods closely allied to the production methods used in plants building machinery in larger quantities. An article in June MACHINERY will describe some of the most interesting operations employed in building machinery of this kind.

GOOD TAPPING RESULTS

Some interesting tapping results indicating long tap life appeared in a recent number of *The Inner Ring*, published by the Skefko Ball Bearing Co., Ltd., Luton, England. The taps with which these results were obtained were ground thread taps made by the S K F Co.'s plant at Gothenburg, Sweden.

In one large railway shop, a 3/4-inch Whitworth nut tap gave a useful life of 42,778 holes, which equalled a tapping cost of 3.6 cents per 1000 holes. A 5/8-inch Whitworth nut tap in the same shop tapped 25,304 holes at a tapping cost of 6 cents per 1000. In another shop we find that a 3/8-inch B. S. F. nut tap tapped 500,000 nuts made from admiralty gun-metal before being discarded. The thread in the nut was 3/4 inch long. In one railway shop, staybolt taps 1 inch in diameter, 11 threads per inch, produced 1000 holes between grinds, each tap being reground from fifteen to twenty times, producing from 15,000 to 20,000 holes.

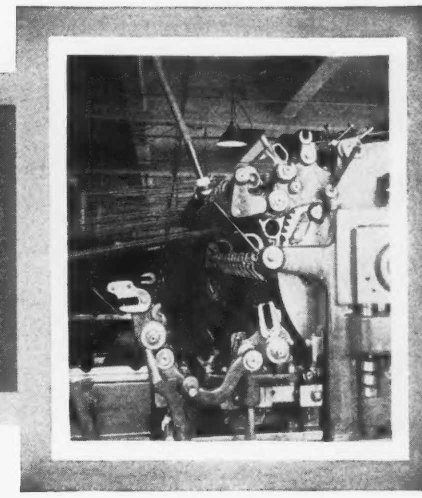
A comparison of ordinary taps with ground thread taps is furnished by the British Piston Ring Co., Ltd., Coventry, England. In this plant, using cut thread 1/8-inch taps, the average results were 1200 blind holes, 1/2 inch deep, in 3 per cent nickel casehardening steel, at a circumferential tapping speed of 15 feet per minute. With ground thread taps, 3000 holes were produced in the same material with one tap. The saving in tapping time by the use of ground taps was approximately 50 per cent, and the saving in cost of taps about 50 per cent.

As an example of what may be done in tapping Acme thread phosphor-bronze nuts, the following results obtained at the Alfred Herbert works in England are quoted. In tapping a cross-slide nut to be fitted to the Herbert No. 9 combination turret lathe, six taps were used, 7/8 inch in diameter, 1/4 inch pitch, 1/2 inch lead, left-hand thread, each tap having four flutes. The length of the threaded nut was 4 3/4 inches, and the nut was tapped complete in ten minutes in a turret lathe.

In addition to the foregoing records, it may be of interest to note some results that have been obtained elsewhere with taps of the same manufacture. At the Horwich Shops of the London, Midland & Scottish Railway, two 1-inch staybolt taps had tapped over 8000 and over 10,000 holes, respectively, up to the time that this information was obtained, and are still in use. Of the total number of holes, some 13,500 were tapped on a machine running at 275 revolutions per minute. In another shop, a 1/2-inch tap with Whitworth threads tapped 35,000 holes in steel headers without regrinding.

Similar tapping results from other shops should prove interesting to MACHINERY'S readers and could well be placed on record.

Ingenious Mechanical Movements



OVER-SPEED LIMITING DEVICE

By C. C. WHITTAKER

There exists, on certain railroads, the necessity of employing a reliable over-speed limiting device, which will prevent the application of further propelling power to an electric locomotive after a predetermined speed has been reached. The prevention of over-speeding protects the traction motors or other locomotive parts from being injured by speeds in excess of that for which they were designed. The device should be so designed that the engineer may again apply power to the locomotive as soon as the speed has decreased to some permissible value.

A device that meets these requirements has been developed by the Westinghouse Electric & Mfg. Co., for application to electric locomotives. It is, however, capable of alteration so that its field of usefulness can be extended to steam or other motive power, as the fundamental device is capable of various simple modifications which will perform different functions as desired. By mounting a Veeder counter on the contact box, a record can be obtained of the number of times an engineer has over-speeded his train. The system may also be interlocked with the air brake by the use of additional relays. One relay can be made to give the engineer a warning and at the same time cause a counter to register. Another relay can start a time element device which will, after the elapse of a definite time, cause the brake pipe to be vented, thus applying the brakes. In case the engineer reduces the speed of the train, when given warning that he is exceeding the prescribed speed, before the automatic feature has had time to work, nothing further will happen and the device will then return to its normal position.

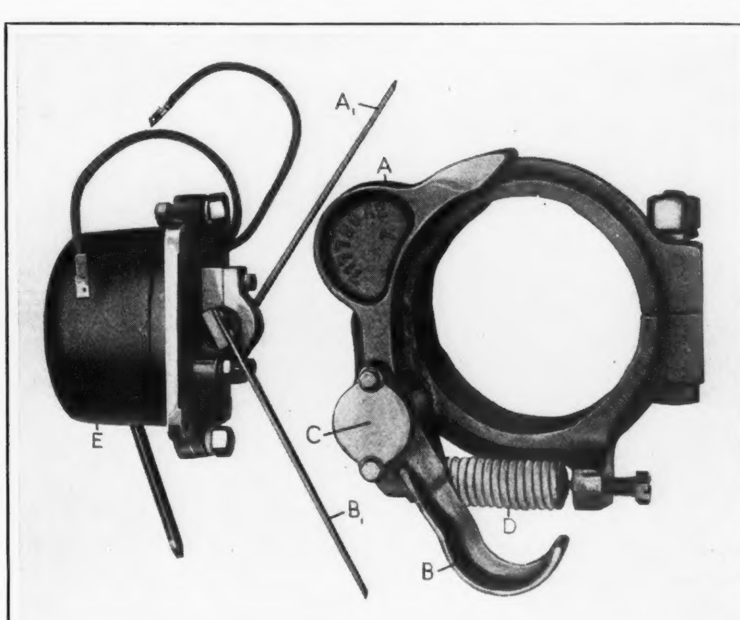


Fig. 1. Device for Electric Locomotives which Automatically Prevents Over-speeding

The centrifugal member seen at the right in Fig. 1 is mounted on the center of an idle axle. One half of this member carries the centrifugal arm and adjusting spring, so that adjustments can be made on the test floor and left undisturbed when applying to the axle. The centrifugal arm has two cam surfaces A and B which are offset one from the other. These cams engage light arms A_1 and B_1 on the contact box, which is mounted close to the centrifugal member, as shown by the relative positions in the illustration.

Normally, a spring D holds the centrifugal arm in the "in" position. At some predetermined speed, the arm flys outward about the center C, compressing the spring, while cam A strikes arm A_1. This motion causes a toggle switch in the contact box E to break contact and thus interrupt the control current to the master controller. Thus further application of power to the locomotive is prevented until the speed is reduced. Upon a reduction of speed to the necessary value, the centrifugal arm moves inward about the center C and cam B strikes arm B_1, causing the toggle switch again to make the circuit in the contact box. This permits the engineer again to apply power to the locomotive. As developed at present, the range of speed between trip out and reset is from 39 to 37 miles per hour in one case and 65 to 60 in another.

In designing the centrifugal member, it was necessary to reduce friction to a minimum and also to produce bearings that would require almost no attention for maintenance. This arm, therefore, was mounted

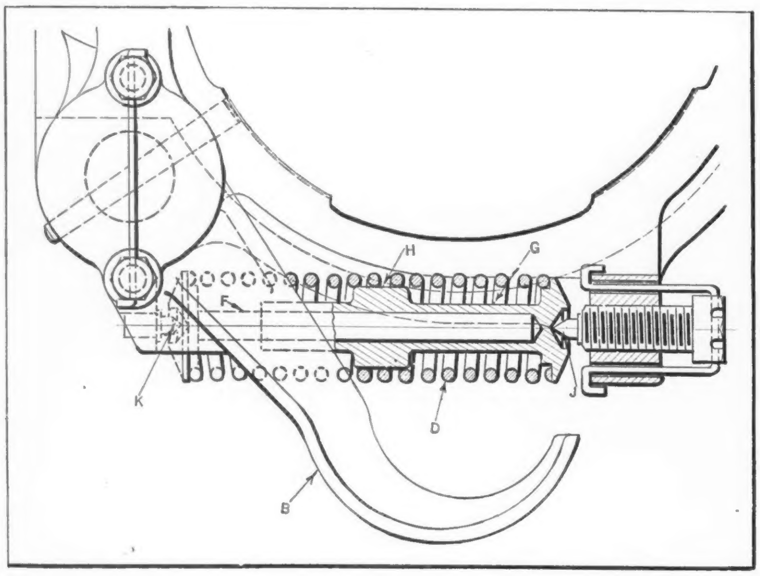


Fig. 2. Detail of Sensitive Spring Mounting for Centrifugal Arm of Over-speed Limiting Device

in a double-row, deep-groove ball bearing, which insures minimum and constant friction over a long period of time. The spring *D* operates between hardened conical points or centers *J* and *K*, bearing in hardened pockets (see Fig. 2). It is restrained from buckling by hardened sliding guides *F* and *G* within the spring. The outside of guide *G* has an increased diameter at *H* to prevent the spring from buckling.

This mounting resulted, on test, in an extremely sensitive centrifugal arm which, depending on the characteristic of the spring, could be made to fly out positively and return for a difference in speed of approximately 1 per cent.

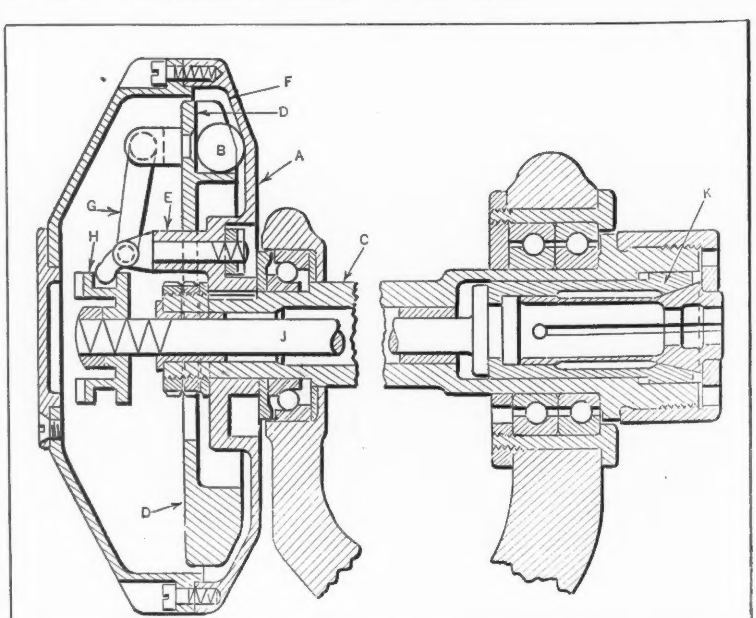
The contact box is designed with special reference to withstanding the hard blows received from the cams. The striking arms are made of hardened steel springs, tapered toward the outer ends to reduce inertia and consequent rebound when the cam strikes. It was found necessary to provide a spring loaded friction drag in box *E* to prevent the striking arms from rebounding and rubbing against the cams.

The moving contact is a light weight element, which is connected to the striking arms only by means of two "over the center" springs, and is supported on knife-edge bearings. The contact does not move until after the striking arms have passed the center. It then snaps over quickly, regardless of the speed at which the striking arms are moving. The contacts are phosphor-bronze flat springs bearing against copper-graphalloy buttons.

* * *

CENTRIFUGAL CHUCK-CLOSING MECHANISM

The automatic chuck-closing mechanism here illustrated is operated by the action of centrifugal force upon balls or spherical weights which move outward when chuck rotation begins, thus automatically closing the collet chuck upon the work. This device is used on a plain screw machine.



Mechanism which Automatically Closes Chuck when Spindle Rotates

The aluminum body *A*, which contains the chuck-closing mechanism, is mounted at the rear of spindle *C*. Sixteen equally spaced steel balls *B* are located in slots formed around the edge of ball-holder *D*. This ball-holder is free to slide forward or backward, and is centered on three supports *E* that form part of body *A*.

The front or chuck end of the spindle is a standard type, and has a collet chuck, as shown. When the spindle and chuck-closing mechanism begin to revolve, balls *B* move outward, due to centrifugal force, and as they engage the inclined surface *F*, ball-holder *D* is pushed backward with a force which increases as the rotary speed increases. This backward movement of *D* causes levers *G*, acting through collar *H*, to push rod *J* and chuck sleeve *K* forward, thus closing the collet chuck about the work.

When the machine is stopped, the balls return to their inner positions and the spring collet chuck opens. This machine has a friction clutch on the spindle with a foot-treadle which controls starting and stopping. E. T.

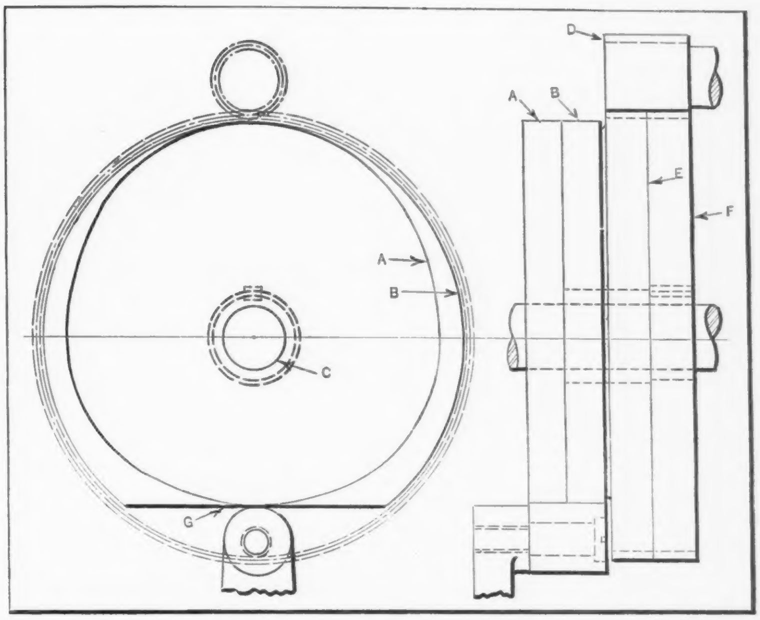
* * *

CAM FOR VARYING MOTION OF FOLLOWER

By J. E. FENNO

An automatic paper-tube rolling machine has a driven member that must dwell during three-fourths of a revolution of shaft *C* and then be given a stroke that varies gradually in length for successive cam revolutions. This variation is obtained by using a cam having two sections *A* and *B*. These two sections are both driven by pinion *D* through gears *E* and *F*. Gear *E* is integral with cam *B* and has 105 teeth, whereas gear *F* is keyed to the hub of cam *A* and has 104 teeth. Both gears have the same outside diameter, and the difference in tooth numbers provides a differential movement between the cams, so that one cam is continually changing its position relative to the other.

The dwell is obtained when the roll of the follower is in contact with the concentric part of cam *B*. When cam *A* is in the position shown, the maximum stroke occurs as the follower traverses across the flat edge *G* of cam *B*. The stroke of the follower is gradually reduced as *A* turns relative to *B*, thus filling the segment-shaped space at *G*, so that finally the cam is nearly concentric all around. The motion of the follower is somewhat irregular, but for this particular application, the irregularity is immaterial, as the essential requirement is to have the follower, after the 364th revolution of the pinion, at a distance from the center of shaft *C* equal to the dwelling position.



Two-part Cam which Alternately Increases and Decreases Stroke of Follower

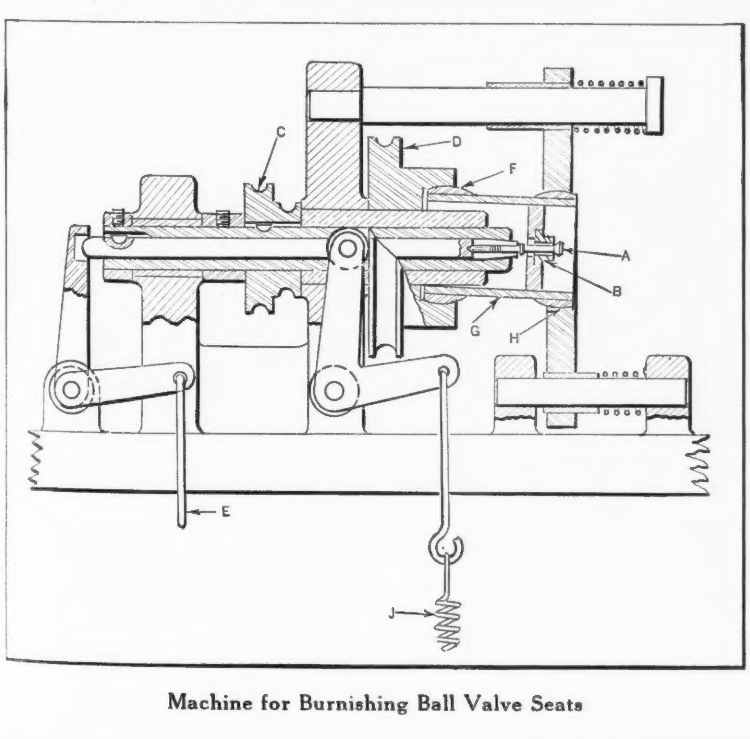
* * *

BURNISHING BALL VALVE SEATS

By A. D. REDNER

This mechanism for burnishing a ball valve seat *B* (see illustration) causes the valve *A* to rotate about its own axis, and at the same time this axis has a planetary conical motion, the apex of the cone being at the center of the spherical surfaces of the valve and seat; hence, local irregularities are eliminated and the density of the metal increased.

The valve *A* is held by a spindle collet which is closed by a foot-pedal attached at *E*. The valve seat *B* fits into a hexagon socket which prevents it from turning. The spindle pulley *C* turns 1500 revolutions per minute, and pulley *D* revolves 100 revolutions per minute. This pulley *D* has a ball socket *F* bored off center, which gives the axis of sleeve *G* a conical motion, the apex of the cone being at point *A* which is also the center of the ball socket *H*. Sleeve *G* does not revolve. A foot-pedal attached to spring *J* is used to hold the valve seat *B* against valve *A* with sufficient pressure to burnish the valve seat properly. Both valves and seats are of brass, and oil is used in burnishing.



Machine for Burnishing Ball Valve Seats

BUSINESS PAPER EDITORS MEET IN WASHINGTON

The National Conference of Business Paper Editors, including the editors of practically all the leading engineering, trade, and business papers of the United States, met in Washington Monday, April 29, at which time the report on economic conditions made by the Committee on Recent Economic Changes, of which President Herbert Hoover is chairman, was presented for the first time in its complete form. The survey on recent economic changes is an outgrowth of the President's Conference on Unemployment in 1921, when three national surveys were undertaken, the present one having been begun in January, 1928, and just recently completed. The survey is a study of post-war developments in American economic life, particularly those that have taken place since the recovery from the depression of 1920-1921. The basic investigations for the Committee on Recent Economic Changes were made by the National Bureau of Economic Research, with the assistance of a great number of governmental and private agencies.

* * *

HOW INDUSTRY GAINS BY GOOD TRANSPORTATION

Because of the fast and dependable transportation service furnished by the railroads, great savings have accrued to shippers during the last few years, according to C. W. Banta, vice-president of the Bank of America. Faster freight service has permitted faster commodity turnover, reduction in the amount of raw material carried in inventories, reduction in inventories of finished products, reduction in the money borrowed to carry inventories, and reduction in the interest paid. It has also made possible quicker receipt of accounts receivable. More and more funds have been released from the capital heretofore required to keep stocks moving.

Current Editorial Comment

In the Machine-building and Kindred Industries

DO TUNGSTEN CARBIDE TOOLS REQUIRE REDESIGNED MACHINES?

There is much discussion of the need for redesigning machine tools to obtain the higher speeds and greater power necessary for utilizing to full advantage the new tungsten carbide tools, but practical experience in many production shops indicates that these new cutting tools can be used to great advantage in machine tools of up-to-date design. In several Detroit automobile plants the new tools have been substituted for the tools formerly used without any change in the machine tool equipment and with satisfactory results.

Only occasionally is the modern machine tool used to its full capacity. It is not generally run at the highest speed of which it is capable, nor is its full power required for the work on which it is used; therefore a reserve of both speed and power exists which can be used advantageously for the new cutting tools.

It has been found that the value of the new tools depends not wholly upon the higher speeds at which it may be possible to machine metal, but also upon the lasting qualities of the tools when run at a more moderate speed; and in many instances the most economical speed must be determined by experiments. Is it one at which metal is removed at a rapid rate, requiring frequent regrinding of the tools, or one where the work is performed at a slower speed, but the tool lasts almost indefinitely? In view of the great cost of the new cutting tools, it is of importance to use them so that they will last as long as possible, and when used in that way present machine tools of the more advanced designs appear to meet the requirements of the new cutting tools.

"Our experiments indicate," says an engineer of a large tractor plant, "that the design of modern machine tools will not be affected to any great extent. In the majority of cases which we have observed, they have given a good account of themselves and proved to have sufficient rigidity and power to carry the load, and sufficient speed for the economical use of the new tools."

* * *

IT PAYS TO SALVAGE SCRAP

In a large manufacturing plant in Chicago, two men are assigned to the work of looking over scrapped parts with a view to salvaging as much as possible of the material that otherwise would be wasted. As a result, over $50,000 worth of material, already condemned to the scrap heap, has been saved in one year. It is the duty of these two men to examine all work rejected by the inspectors and to determine whether the defects are serious enough to warrant throwing the material away or whether the parts can be salvaged and put to effective use.

Many parts rejected by the inspectors and unsuitable for use in their present condition may be salvaged by refinishing or reconditioning them. Dies, jigs and fixtures that become obsolete are also looked over, and such parts as may be used in the future in the building of other tools—such as die-blocks, for example—are salvaged, while the remainder may be scrapped. Products that become obsolete because of being replaced by improved designs and those that do not move readily off the company's shelves are also dealt with by the salvage department, which selects any parts which may be used in other products before assigning the remainder to the scrap heap.

Every manufacturer may well examine the scrap heap to see if it is eating into his profits. Sometimes too large quantities are manufactured of certain parts without due consideration of the demand. Sometimes there is excessive waste because of unnecessarily rigid inspection. Sometimes a simple and inexpensive operation will correct a rejected part that would otherwise be scrapped.

* * *

THE VALUE OF FOREMEN'S CONFERENCES

The day has long since passed when a man was considered a good shop foreman because he was a good "driver." Leadership now is one of his most valuable characteristics. Sometimes this quality is referred to as "executive ability," but the word "leadership" is more expressive than the other term, which is vague.

Many large industrial concerns have recognized that some of the important problems of management can be solved only through the intelligent co-operation of their foremen. This is particularly true of the problems arising from the relations between the employer and employes. Many managers have therefore taken steps to develop the abilities of their foremen through foremen's conferences.

The article "Foremen's Conferences Develop Leadership" in this number of MACHINERY explains how these conferences, when carefully organized, will give each foreman in a plant the benefit of the training and experience of his fellow foremen. Many valuable ideas lie dormant in every industrial organization, and it is the object of these conferences to bring to light the thoughts and ideas of the foremen throughout the plant.

Valuable results have been obtained from these conferences. They have assisted in developing leadership qualities and in giving the foremen a broader view of their work and duties. They have made it possible for the foremen to see the plant as a whole and not to look upon their own departments as the only ones with which they are concerned. When they take that narrow viewpoint, it frequently leads to petty jealousies, lack of cooperation and uneconomical practices.

Foremen's Conferences Develop Leadership

Foremen's Conferences When Carefully Organized Will Give Each Foreman in a Plant the Benefit of the Training and Experience of All the Others

IT is becoming more and more recognized that many of the problems of management can be solved in a satisfactory manner only through the cooperation of the foreman; and, furthermore, most of the problems in the relations between employer and employes can be handled only through intelligent action on the part of the foreman. As corporations grow larger, this becomes increasingly true.

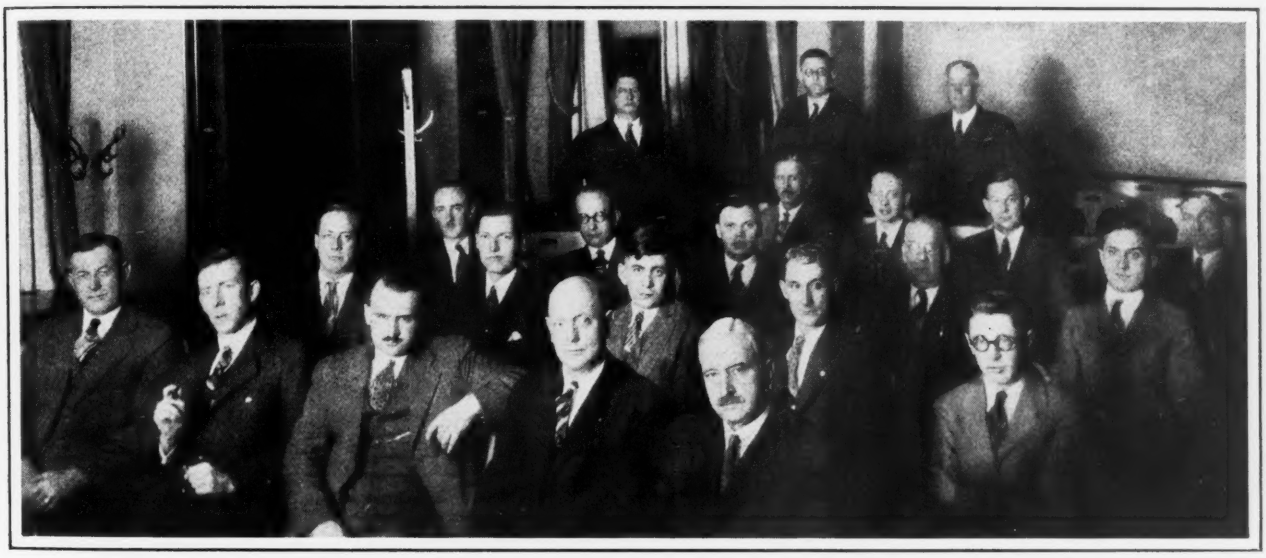
There never was a time when leadership was needed to so great an extent as at present, not only at the top, but throughout an organization; and any industrial enterprise that expects to progress must endeavor to train its foremen in leadership. A capable foreman must be able to think out a problem without jumping at conclusions. He must be able to plan, and when an emergency arises, he must be able to act quickly, to give explicit orders, and keep cool. He must be able to assume responsibility; and if he is to be a worthwhile foreman, he must also be given responsibility, as well as authority.

Now the question arises, how are we to find men with all these qualifications? As a matter of fact, there are very few such men available; in most cases, special steps must be taken to develop their latent abilities. The methods now being employed in the state of Ohio for the purpose of bringing out the best qualities in foremen will be briefly outlined in this article.

In Ohio, the State Board for Vocational Training has organized a special "foremen conference service" which cooperates with the industries in organizing what are known as leadership conferences, for the purpose of inaugurating systematically conducted foremen's conferences. At these, the foremen may have a chance to exchange ideas, become acquainted with the policies of their company and the underlying reasons for those policies, and contribute their own ideas, based on their experience and training, toward the solution of the problems that arise in the management of a plant.

Many Valuable Ideas Lie Dormant in Every Industrial Plant

Of late years, industrial managers have come to realize that their foremen, in the aggregate, possess a vast amount of practical knowledge, which, if properly obtained and recorded for the benefit of the plant as a whole, would improve production methods and working conditions, create better feeling between employer and employes, and in general make the enterprise more successful in many directions. Hence, these foremen conferences that have been inaugurated in the state of Ohio are not intended merely to train or educate the foreman, but fully as much to obtain from him the help and assistance that he can render.



Cincinnati Machine Shop Executives Taking the Conference Leadership Course Provided by the Ohio State Board for Vocational Training

The general idea of these conferences is to bring together the foremen in a given plant, submit to them some one problem that is causing difficulties in the shop, and obtain from these men, who are familiar with all the details surrounding the problem, the best means of its solution. Through such conferences, specific remedies are obtained to overcome present difficulties in the shop, and a cooperative spirit is created between the foremen, who are likely to work together for a common purpose to a greater extent after having threshed out a problem in this manner.

An opportunity is also provided for the foreman, through these conferences, to develop leadership, broaden his outlook, and obtain a vast amount of information through the discussions that take

place. The foremen's conference is a place for exchanging ideas and pooling information relating to the daily work in the shop. It is evident that the ideas coming from practical foremen must, as a rule, be practical ideas, and are as valuable to the management as to the foremen themselves.

The Assistance Rendered by the State Board for Vocational Education

In the state of Ohio, the State Board for Vocational Education assists any industry or group of industries in inaugurating foremen conferences in a plant or a community. At present, conference leaders are being trained in a special course, because it is necessary that the executives who are planning to arrange for foremen conferences in their own shops should know what the conference method is and how to use it. In Cincinnati, a large number of machine shop executives have taken the conference leadership course, with results that, we understand, have been unusually gratifying. Wherever the method has been applied, it has proved successful, almost without exception, and both executives and foremen have been enthusiastic about it.

A Course to Train Conference Leaders

An actual course is laid out for the training of conference leaders. This course is intended to do three things for an industrial executive: First, it will give him a knowledge of the conference method and how to use it in discussing an industrial topic with a group of foremen; second, it develops an executive into a conference leader; third, it acquaints the executive with the available material for successfully conducting foremen conferences—material in the way of books, courses, and bulletins. It also teaches him how to select and handle plant problems in the discussions and assist him in developing a foremanship conference program for his plant.

After an executive has completed the conference leadership course, he organizes the foremen in his plant into groups of about twenty men each, and with the assistance of these groups he plans the foremen conferences. Groups should not be larger than twenty, and in many plants it is considered that ten or twelve is all that should be brought together in one group, because the object is to have all the foremen participate in the discussion. The conference is not effective if the group is too large. In a large plant, all the foremen may be assembled for lectures on some topic, but following the lecture, they should be divided into groups under the leadership of a trained conference leader.

Brief Outline of How the Conference Works

If a group of foremen decide that at their next meeting they will discuss a safety topic, it then becomes the business of the leader to plan the conference. This is really the most important job in the whole procedure, because without an adequate plan, the conference method is not successful. The leader must so plan the conference that he knows what the objectives should be, and how they should be obtained. A general all-around discussion will lead nowhere.

A subject that has been discussed with good results is as follows: "What are the causes of accidents in our plant?" With the average group of foremen in the average plant, a blackboard analysis in the conference will generally bring out the following causes of accidents: Carelessness and indifference; inadequate instruction of the worker; poor judgment as to speed, distance, or strength of materials; poorly guarded machinery; guards left off for repairs; defective material or machinery; unsatisfactory or inadequate tools; sickness, worry, fear, fatigue (of late, sometimes, too much radio); disobedience; dissipation; quick temper and misunderstanding; too much enthusiasm, excitement, and too much speed; and taking too much of a chance to save materials, time and effort. The next conference might well be devoted to how to overcome as far as possible these causes.

What Results Have Been Obtained from These Conferences?

Briefly summarized, foremen's conferences, of which hundreds are now being held every month in important plants, not only in Ohio, but in many other states, have brought about the following results:

(1) They have assisted in developing leadership qualities in the foreman; (2) they have aided him in studying and analyzing his job; (3) they have given him a broader view of his job and duties; (4) they have given him a better understanding of human relations in industry; (5) they have decreased petty "fussing" and increased cooperation; (6) they have promoted a better understanding of the principles of good management (not only on the part of the foremen, but on the part of management itself); (7) they have assisted foremen in grasping the fundamentals of practical business economics; (8) they have given the foremen a better understanding of the planning of work and of organization; (9) they have tended to eliminate "bossing" and have emphasized the value of teaching ability in training new employes; (10) they have enabled the foreman to see the plant as a whole and his own part in the organization.

In a number of articles to follow, the details of the foremen conference method, with examples of some of the problems discussed and the results obtained, will be dealt with.

* * *

NEW AIRPLANE COOLING FLUID

The development of a new cooling agency which can be used to replace water in airplane engines at a great saving in weight and efficiency has been announced by the War Department. The fluid has a boiling point of 387 degrees F., compared to 212 degrees for water, and 4 1/2 gallons will serve the purpose of 18 gallons of water, a saving of 84 pounds in weight. While the chemical formula has not been made public, the War Department is reported to have made the statement that its ingredients may be purchased in the open market at comparatively low prices. The fluid was developed at the laboratories of the Army Air Corps Material Division at the Wilbur Wright Field in Dayton, Ohio.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

TABLE BUFFING MACHINE

By J. D. STEWART, Plant Engineer, Atlantic Coast Line Railroad Co.

The table and buffing machine equipped with a dust collector and fan, shown in the accompanying illustrations, have proved useful and economical for buffing locomotive main rods, side-rods, valve gear parts, cross-heads, and various other heavy and irregular pieces. The buffing wheel *A*, Fig. 1, is so mounted that the operator can turn it in any direction, swing it sidewise, move it up or down, or revolve it around the axis of the supporting arm. This makes it possible to buff or polish surfaces of any size or shape quickly and easily. The table affords a convenient surface on which large and heavy parts can be handled with comparative ease.

Fig. 2 shows a heavy side-rod on the buffing table. Usually a length of pipe is placed as shown, so that the rod can be rolled back and forth or turned as desired. The buffing wheel, shaft, and bearings are made removable from the frame, so that the wheel can be quickly replaced.

The dust collector system is a valuable feature. The clouds of dust formerly raised when buffing whitewashed or heat-treated pieces, so objectionable to other workmen as well as to the operator, are no longer present. The collector takes practically all the dust as it leaves the wheel. The pieces are brought to and carried away from the bench by a crane.

The table *C*, Fig. 1, is made of structural steel. It is 2 feet 6 inches high, 3 feet 5 inches wide, and 10 feet long, and is covered with 2- by 12-inch boards. Integral with the back of the table is a vertical frame *D*, 12 feet high. There is an extension *E* from the top of the vertical frame, which holds a 6-inch grooved wheel *F* over which passes a 1/2-inch cable *G*. The weight *H* at one end of this cable balances the weight of the overhanging buffing wheel.

The three-horsepower driving motor *J*, mounted on a platform at the top, is coupled to a 1 3/16-inch shaft *K* by means of a flexible coupling *L*. This shaft is supported at each end by roller bearings mounted on angle-iron brackets. The vertical arm *M* is swung from the shaft by two ball hanger bearings. The bottom fork of this hanger is attached to the arm by a swivel joint *N*.

A 4-inch pulley *O* on the shaft *K* drives the 9-inch pulley *Q* on the 1 3/16-inch bottom shaft supported by fork shaft *P* by means of a 2-inch belt. The horizontal arm *R* is attached to its back fork by a swivel joint *NN*. The fork is connected to shaft *P* by the two inner ball hanger bearings. The drive continues from a 4-inch pulley *S* on the forked shaft *P* to a 3-inch pulley *T* on the buffing wheel shaft by

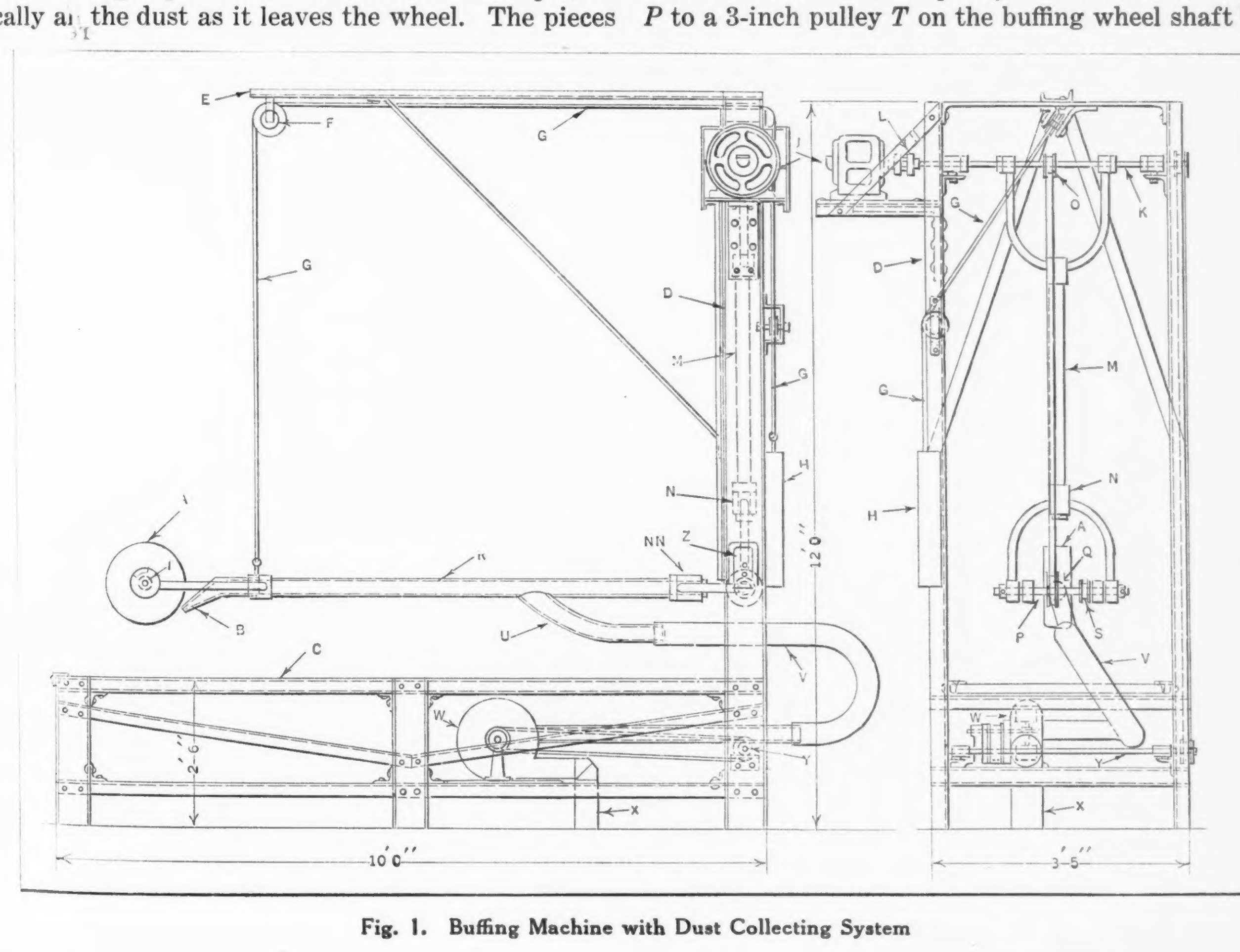


Fig. 1. Buffing Machine with Dust Collecting System

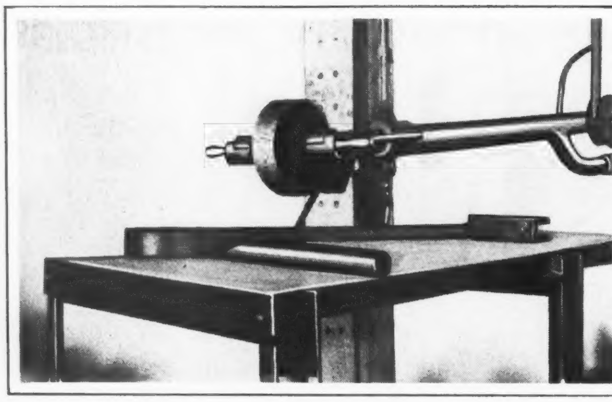


Fig. 2. Buffing a Locomotive Side-rod

means of a 2-inch belt. The buffing wheel runs at approximately 600 revolutions per minute. A push-button starter *Z* on the frame controls the motor.

The dust is collected by a nozzle *B*, and passes through the 3-inch flues *R* and *U*, thence through the steam hose *V*, through which it is drawn by the small blower fan *W*, finally being discharged into a pit beneath the floor by way of pipe *X*. The fan runs at about 1600 revolutions per minute. It is driven by a 3-inch pulley mounted on its rotor shaft, which is driven by a 2-inch belt from a 6-inch pulley mounted on a 1 3/16-inch countershaft *Y*. On one end of this shaft is a 4 1/2-inch pulley which receives the drive from another pulley of the same size, mounted on the upper shaft *K*.

The buffing wheels, made of paper, are from 10 to 12 inches in diameter, and have a 4 1/2-inch face. The rim is coated with heavy glue and then rolled in emery dust. When a wheel wears out, it is given another coating of glue and emery dust.

FIXTURES FOR LAYING OUT LOCOMOTIVE AXLE KEYWAYS

By C. N. CAGLE, Central of Georgia Railway Shops

A fixture that facilitates "quartering" or laying out locomotive driving axle keyways is shown in the accompanying illustration. It consists essentially of a base *A*, a vertical sliding member *B*, and a locating center *C*, which is a sliding fit in member *B*. The center *C* is backed up with a coil spring *D*.

The procedure in stamping or laying out a keyway at right angles or "quartering" positions on the opposite ends of a locomotive axle, is as follows: First, locate the axle on a surface plate, using blocks to bring its axis parallel with the surface of the plate. Next, with the base of the fixture firmly in contact with the surface plate, locate the center *C* in the center machined in the end of the axle and push the fixture toward or against the end of the axle until the face of member *B* is in contact with the end of the axle.

The two sides of the vertical arm of member *B* can now be used as a guide in scribing lines which locate the position of the keyway. Without changing the position of member *B* on base *A*, transfer the complete fixture to the opposite end of the axle, and using the proper arm of member *B* as a guide, scribe the two lines for the second keyway. As the three arms of member *B* are spaced 90 degrees apart, it does not matter which keyway of the axle is located first.

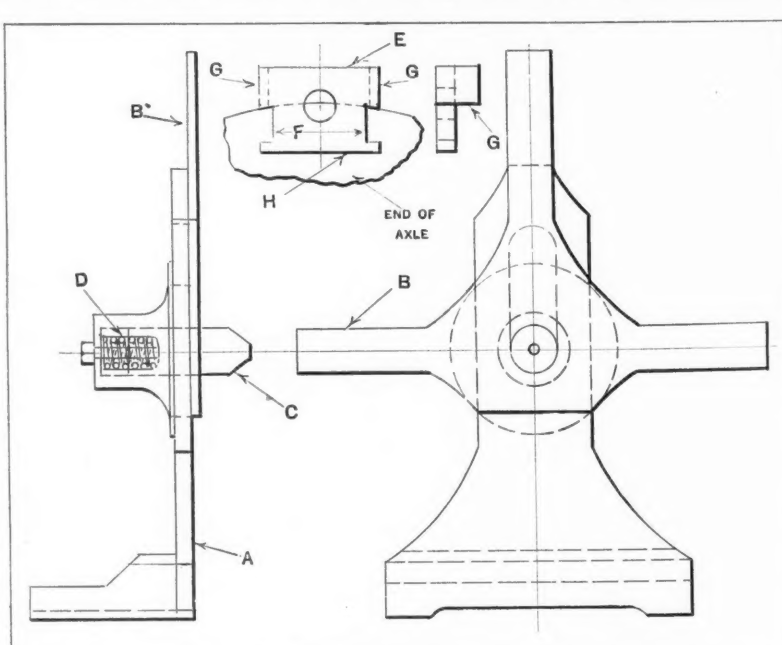
The simple fixture shown at *E* is next used for scribing the line that indicates the depth or bottom of the keyway. This fixture is shown to a scale double that of the fixture just described. The lower edges of the projecting lugs *G* are rested on the periphery of the axle, and the sides of the fixture machined to the width *F* are brought into alignment with the lines already scribed on the end of the axle. The lower edge of the fixture at *H* is now used as a guide in scribing the line that indicates the depth of the keyway.

* * *

THE CHICAGO MACHINERY MART

Plans are being made in Chicago for the building of a machinery and equipment mart. The building will be a monumental structure sixteen stories high and containing nine million cubic feet of space. One of the features of this machinery and equipment mart is that its operation will be under the supervision of a board of governors to be composed of men in the machinery field who will be chosen by the tenants. The location selected is at Canal, Monroe, and Clinton Sts., the building having a street frontage covering an entire block in the heart of the machinery district in Chicago, and convenient to railroad stations and the hotel district.

It is also proposed to provide quarters for a new Machinery Club in the new building, which it is expected will be ready for occupancy May 1, 1930. An organization committee consisting of a large number of prominent men in the machinery field in Chicago are organizing the new Machinery Club of Chicago, and it is receiving enthusiastic support from those engaged in machinery marketing and manufacture in Chicago and vicinity.



Fixtures Used in Laying out Keyways of Locomotive Axles

Is Your Scrap Eating Up Your Profits?

How One Manufacturer Saves Thousands of Dollars Yearly by Keeping a Careful Check on Obsolete Tools and Rejected Work

FIFTY thousand dollars worth of material which had been condemned to the scrap heap was saved in one year in the plant of the Stewart-Warner Speedometer Corporation, Chicago, Ill., by assigning two men to the task of looking over the scrapped parts with a view to salvaging as much as possible. Men with wide experience in the various manufacturing processes of the company were selected for this work, because it was felt that these men could visualize applications for parts designed for entirely different purposes. The results obtained entirely justified their selection.

All Rejected Work is Examined for Possible Salvage

Every manufacturing department of the plant has inspectors assigned to it, so that work which does not come within the specifications of blueprints is rejected before it leaves the department and can be readily traced to the man or machine responsible for it. Assembly lines have inspectors at the end of various steps, thus preventing defective units from passing through the entire line before they are discovered. However, before rejected work is actually scrapped, a man thoroughly familiar with all the products of the company looks over the parts carefully to determine whether the defects are serious enough to warrant scrapping or whether the parts can be salvaged.

This man makes a daily report to each department head and to the production manager, factory manager, and superintendent, pointing out the amount and nature of rejected parts and also the machines and men responsible for them. As a result of these reports, steps are usually taken to remedy the conditions. The production manager also receives weekly reports which assist him in ordering replacements for parts scrapped.

Under the supervision of the "specialty" man, which is the name applied to the man who controls the scrap, there is a machine department for salvaging parts by refinishing or reconditioning them. Rejected parts of each kind are generally allowed to accumulate until there is a sufficient number to warrant setting up the necessary machine. The specialty man is the final authority on all scrap, and saves many thousands of dollars a year by preventing unnecessary discarding of tools and parts.

A Check is Kept on Obsolete Tools

When dies, jigs, or fixtures become obsolete, they are transferred to a "slow-moving" stock-room and held there for a reasonable length of time. Then the production department is called into consultation to determine whether there is any likelihood of the tools being used again for a subsequent job. If the chances are against it, individual parts that can be installed in future devices, such as die-blocks, are salvaged, while other parts are scrapped.

Considerable quantities of unused small tools, such as drills, taps, and reamers, become obsolete because of changes in products or the discontinuance of products. Such tools are kept in stock on a minimum quantity basis as, for instance, if 100 drills of a certain size are used per month, the minimum quantity to which the stock is permitted to fall is specified as 50, and when the stock is reduced to that number, about 100 drills, or another month's supply, are purchased. Practically the entire quantity of these drills may become obsolete for the use to which they were to be put by the Stewart-Warner Speedometer Corporation, if changes are made in the product soon after the supply has been replenished. In such cases, endeavors are generally made to have these tools taken back by the concern from whom they were purchased, but if this plan is not feasible, they are disposed of to second-hand dealers or other concerns.

Obsolete Work is Placed in "Slow-moving" Stock-room

In a business such as that in which this concern is engaged, products often become obsolete through being replaced by improved models. Also, they may become obsolete because they fail to meet with popular demand. Such products are also assigned to the slow-moving stock-room and held for about one year. Then the stock-room attendant notifies the salvage department, which carefully examines the work, selecting any parts or units that can be used in other products and sending all other parts or units to the scrap heap. It was in this department that the saving of $50,000 mentioned at the beginning of the article was realized in one year alone.

In addition to saving money by insuring inspection of obsolete work before consigning it to scrap, an important advantage of this department is that an annual inventory of all stores is assured. In many plants, obsolete products are allowed to accumulate over a period of years, resulting in inflated inventories and false profits. This also means that expensive floor space is consumed in a way that does not produce dividends.

Scrap is Kept Separate so as to Realize Best Prices

All varieties of scrap, that is, steel, brass, iron castings, etc., are kept in separate bins, so as to realize the best possible prices in selling. Sheet-steel scrap is compressed into bales measuring about 12 by 8 by 6 inches, since baled scrap brings higher prices than loose or "skeleton" scrap. Screw machine turnings, when crushed, also bring higher prices than when whole. Malleable iron, gray iron and steel castings are kept separate. since the different prices warrant this practice. Worn-out cutters of high-speed steel are accumulated in one bin to be disposed of when a sufficient quantity is on hand. Old machines are sold to second-hand dealers or direct to users.

Whenever tools and parts that are purchased on the outside are consigned to the scrap heap, a re-

port is made to the production department, so that supplies can be ordered for replacement purposes. Raw materials that do not meet specifications are returned to the shipper to avoid rejections after parts have been made from the stock. Bar and sheet stocks that become obsolete through the discontinuance of products are investigated to determine whether they can be substituted for stocks of slightly smaller or larger dimensions. If not, the stocks are placed on a surplus list and turned over to the salvage sales department, which gets in touch with various outlets. When the stocks cannot be disposed of in this manner within a reasonable length of time, they are cut up into scrap.

It is important to remember that the final disposal of all obsolete or defective work, unsuitable raw materials and tools, etc., should be entrusted to engineers or mechanics familiar with the products of the concern, who can visualize probable applications, as outlined in this article.

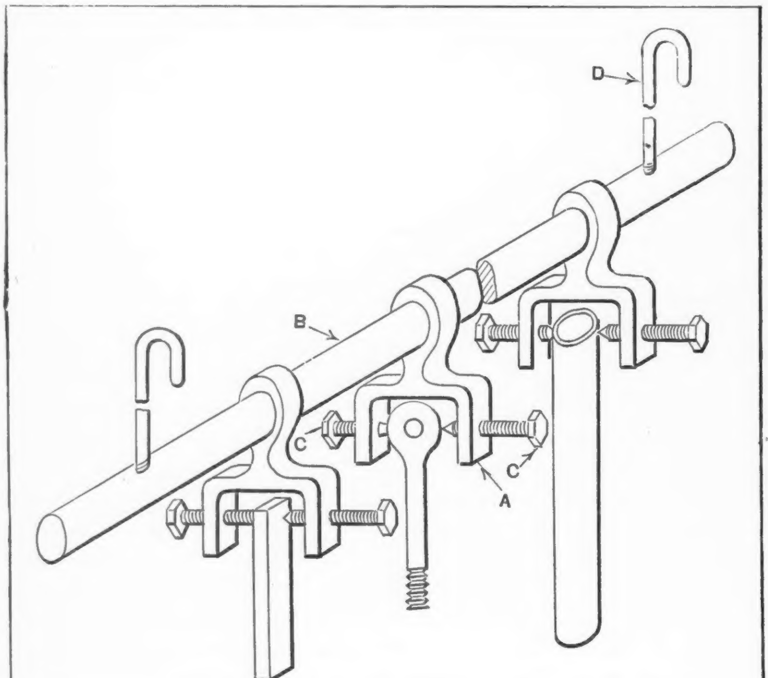
* * *

SUSPENSION BAR AND CLAMPS FOR ELECTROPLATING

By PETER HAGEN

In the accompanying illustration is shown a suspension bar designed to permit pieces of various shapes and sizes to be suspended in a plating bath with practically their entire surfaces exposed to the bath. The clamps *A* are a sliding fit on the bar *B*, and can be spaced to suit the parts to be plated. The area of the surfaces covered by the conical points of the clamping screws *C* is so small as to be negligible.

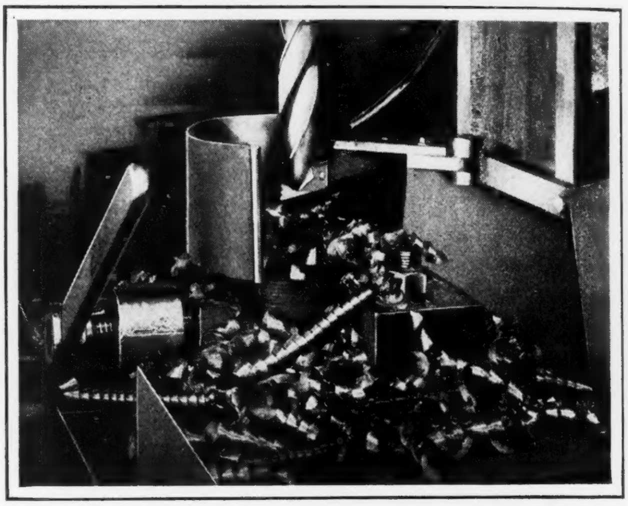
Two or more clamps can be used to support large pieces when necessary. Hooks such as shown at *D* permit the work to be suspended in the solution from the spanning bar of the plating tank. The equipment must, of course, be made from a material suitable for the kind of plating to be done.



Bar and Clamps for Suspending Work in Plating Bath

SAFETY CHIP-BREAKER AND GUARD

In one of the departments of the General Electric Co.'s River Works at West Lynn, Mass., great difficulty was caused by flying chips on a drilling machine. These chips were a continual source of danger not only to the man tending the machine but also to passersby. In addition, the fallen chips scattered on the floor and proved dangerous, as well as unsightly. A device consisting of a chip-breaker and guard was installed, as shown in the illustration. The guard prevents the chips from scattering, while the chip-breaker prevents the formation of long continuous chips. This device has proved very successful since its inception.



A Simple Chip-breaker and Guard for Drilling Machines

* * *

ROCHESTER MEETING OF THE A. S. M. E.

A meeting of the American Society of Mechanical Engineers will be held in Rochester, N. Y., May 13 to 16. This meeting of the society will be the first general meeting to be held in Rochester, and is the first meeting of the society to be held in New York state, outside of New York City, since the Buffalo meeting in 1915. A comprehensive program has been arranged, covering many fields of mechanical engineering. The Machine Shop Practice Division will hold a session Wednesday, May 15, at which papers on large spiral bevel and hypoid gears and on diamond metal-cutting tools will be read. Other sessions will be devoted to education and training for the industries, power transmission, applied mechanics, boiler furnace refractories, boiler feed water, heat transmission, wood industries, materials handling, economizers and preheaters, mechanical springs, pumps, and management problems. Excursions to many of the well-known plants in Rochester are planned.

* * *

A shop is in order when there are no unnecessary things about, and all necessary things are in their proper places.—*Foreman's Magazine*

Heat-treating Forgings in Electric Furnaces

Principal Features of Electric Furnace Equipment Installed in a Modern Forge Shop for Hardening and Tempering Various Small Parts in Quantity

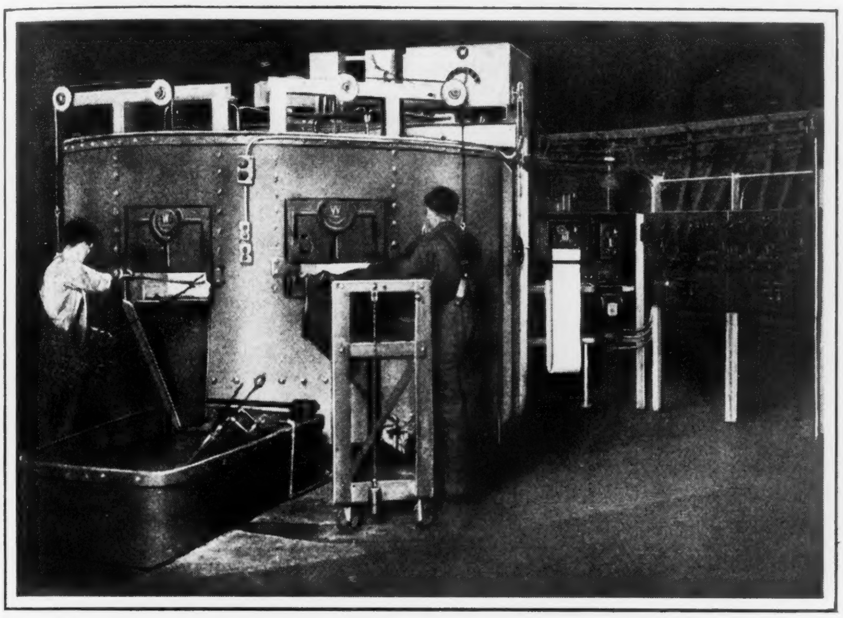


Fig. 1. Electric Rotary-hearth Furnace in which Forgings are Uniformly Heated for Hardening

IN order to insure uniformity of heat-treated work, J. H. Williams & Co., Buffalo, N. Y., has installed an electric rotary-hearth hardening furnace and three "Homo" tempering furnaces equipped with accurate means of temperature and heating-period control. This equipment may be seen in the accompanying illustrations. Drop-forged tools, automobile connecting-rods, spring clips, shock absorber parts, rocker arms, aircraft forgings, and similar parts are handled in the rotary-hearth furnace shown in Fig. 1, while chrome-molybdenum steel "Superrenches" and other forgings that can be placed in baskets are handled in the "Homo" furnaces illustrated in Fig. 2.

The work is charged or loaded on the hearth of the rotary furnace at intervals by means of the special device seen in front of the right-hand door. This charging equipment has a double-table arrangement, the lower member of which is advanced into the furnace and withdrawn by means of a rack-and-pinion mechanism actuated by turning a crank-handle. The upper member of the table is shorter than the lower and floats on it. Work-pieces are placed on the front end of the lower member when the table is withdrawn, the lower member projecting a considerable distance beyond the upper.

In charging work into the furnace, the complete table is fed forward as one unit until the work-pieces are all above the furnace hearth. Then, as the operator reverses the rotation of the crank, the lower table member is withdrawn, but the upper member remains stationary until it has brushed all the work-pieces from the lower member onto the hearth. When this has been done, the two members withdraw together. By this method, the work is spread in a thin layer uniformly around the hearth.

After the work has been charged into the furnace and the door shut, the hearth remains stationary for a predetermined length of time and then indexes to bring the thoroughly heated work in front of the left-hand door for quenching, and the previously emptied space on the hearth in front of the right-hand door, for loading. Thus it will be seen that charging and removal of the work are accomplished at the same time by the operator and his helper.

Hydraulic mechanisms, conveniently operated through foot-treadles, facilitate opening and closing the furnace doors. A red electric light bulb on the front of the furnace goes out to indicate each indexing of the furnace, while another light direct-

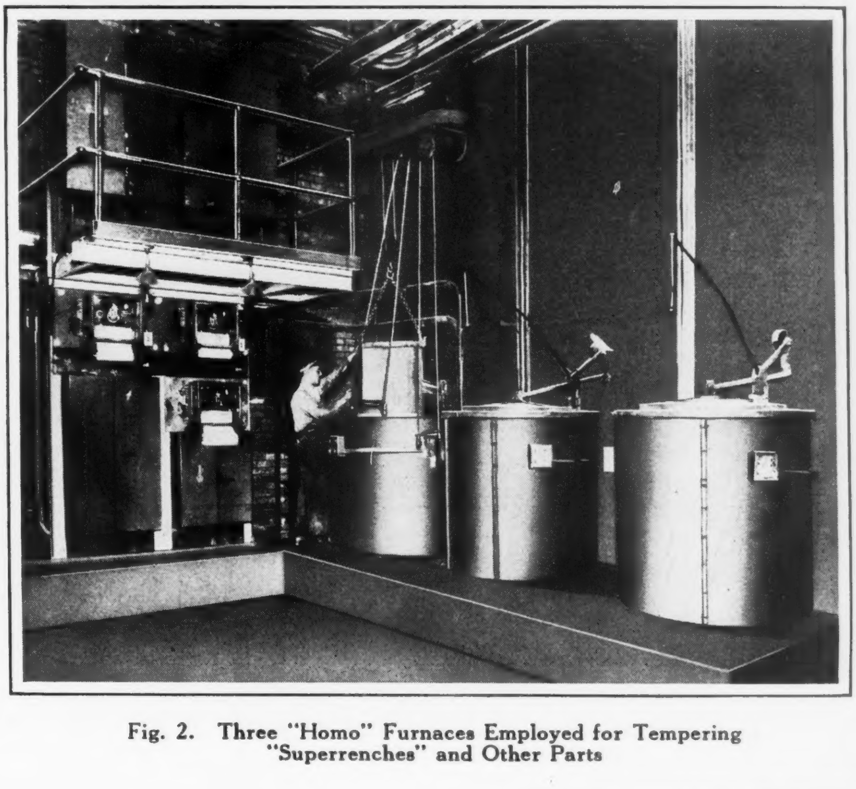


Fig. 2. Three "Homo" Furnaces Employed for Tempering "Superrenches" and Other Parts

ly above it shows whether or not the furnace timing system is functioning. This timing system governs the intermittent movements of the hearth.

Generally, the hearth driving mechanism is so arranged that the hearth is revolved once every forty minutes, but the speed can be changed to meet requirements. During most of the cycle, however, the hearth is stationary. It measures 7 feet in mean diameter, and is 17 inches wide. The part of the hearth on which the work is placed is made up of Nichrome castings, which are raised 3 inches above the refractory body of the hearth to permit free radiation of the heat under the hearth plates, thus heating the work quickly. The furnace has a rating of 126 kilowatts and operates on 110-volt three-phase current.

Most work is heated to a temperature of between 1425 and 1550 degrees F. The heating elements are arranged in two zones, one-half of the furnace being in each zone. Separate contactors and pyrometers are provided, so that one or both zones may be used at will. The heating elements of the last zone raise the parts to the quenching temperature. Nichrome ribbon resistors having a cross-section of 1/10 by 1 inch are employed. This furnace was built by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

The hearth is driven by a three-horsepower motor from which power is delivered through worm-gear and bevel-gear speed-reducing units to a spur gear which meshes with a rack on the hearth, the total reduction ratio being 1300 to 1. Eight wheels running on a railway track support the hearth. A 1/4-horsepower motor drives the timing mechanism through a Reeves variable-speed transmission. Leeds & Northrup temperature-recording potentiometer pyrometers are used for the furnace. There are three transformers of 100 kilovolt-amperes capacity, located adjacent to the furnace for transforming 2200-volt current into 110-volt current with little line loss.

Quenching of the work is accomplished piecemeal rather than in bulk, the parts being pulled from the hearth by means of tongs and permitted to slide down a chute into the water tank. When the same pieces are to be drawn later in the "Homo" furnaces, they fall into a basket at the bottom of the quenching tank. This basket is then raised and immersed into a soda wash, after which it is placed in the tempering furnace. An oil quenching tank is located at the left of the water tank. The water is replenished from the regular supply line, and the oil quench temperature is kept down by means of cooling equipment.

Two of the Leeds & Northrup "Homo" forced-convection drawing furnaces shown in Fig. 2 are designed for use at temperatures up to 1200 degrees F., while the third is suitable for temperatures up to 800 degrees F. All three furnaces accommodate a basket 21 inches in diameter by 26 inches deep. Leeds & Northrup temperature-recording potentiometer pyrometers also control the operation of these furnaces.

The rotary-hearth furnace and the tempering furnaces are served by a hoist of 2000 pounds capacity, which runs on a single track installed overhead in a manner that greatly facilitates the work of the furnace attendants. Lift and travel movements of this hoist are controlled electrically from the floor.

Charts for Finding Weight of Helical Springs

A Series of Charts Designed for Rapidly Determining the Weight of Helical Springs Made from Either Round or Square Wire

By J. W. ROCKEFELLER, Jr., Consulting Engineer, New York

IN designing helical springs, it is often necessary to determine the weight. With the weight known, the amount of material required to make a given quantity of springs may be obtained and the cost determined. In some cases, it is necessary to know the weight of the spring in order to determine certain kinetic properties, as, for example, the period of vibration of a spring under a given load.

The chart shown in Fig. 1 may be used for determining the weight of a spring made from any circular section wire that is manufactured in accordance with the Washburn & Moen gage system. This covers the majority of steel springs. The chart shown in Fig. 2 is for use in finding the weight of helical springs made of square section wire, while the chart in Fig. 3 is for springs of circular section wire made according to the Brown & Sharpe gage, which includes most non-ferrous alloys. The decimal equivalents of the various gages are given in a table on page 425 of MACHINERY'S HANDBOOK, Sixth Edition.

To determine the weight of any spring, the volume of material per inch of solid height of the spring is first obtained from the chart. The horizontal lines of the chart represent the mean diameter D of the coil, the oblique lines represent the size of wire d from which the spring is coiled, and the vertical lines represent the volume of material q per inch of solid height of the spring.

When q is obtained from the chart, the weight of the spring is determined by multiplying this factor by the solid height of the spring, times a constant M, which represents the weight of the material per cubic inch. The value of M for the more common spring materials is as follows: For steel $M = 0.288$; for brass, 0.310; for bronze 0.321; for nickel silver 0.314; and for monel metal, 0.325.

Example 1—We have three helical springs designed for the same purpose, giving equal deflections under a given load and producing equal stresses in all cases, but made from different size wire as follows:

1. The first spring is made from No. 2 Washburn & Moen gage steel wire, and has a solid height of 3 inches and a mean diameter of 1.85 inches.

2. The second spring is made of No. 1 Washburn & Moen gage steel wire, and has a solid height of 2 inches and a mean diameter of 2.4 inches.

3. The third spring is made of No. 0 Washburn & Moen gage steel wire, and has a solid height of 1 1/2 inches and a mean diameter of 3 inches.

Now by using the chart Fig. 1, prove that each of these springs has approximately the same weight. In the case of the first spring (1), we have the volume of metal in the spring per inch of solid height $q = 1.18$ cubic inches, according to the chart Fig. 1. Now with the given values we obtain the weight Q of the spring as follows:

$$Q = q \times SH \times M$$

Substituting numerical values,

$$Q = 1.18 \times 3 \times 0.288 = 1.02 \text{ pounds}$$

Now in the case of the second spring (2), we have $q = 1.7$, according to the chart Fig. 1. Thus for this spring we have,

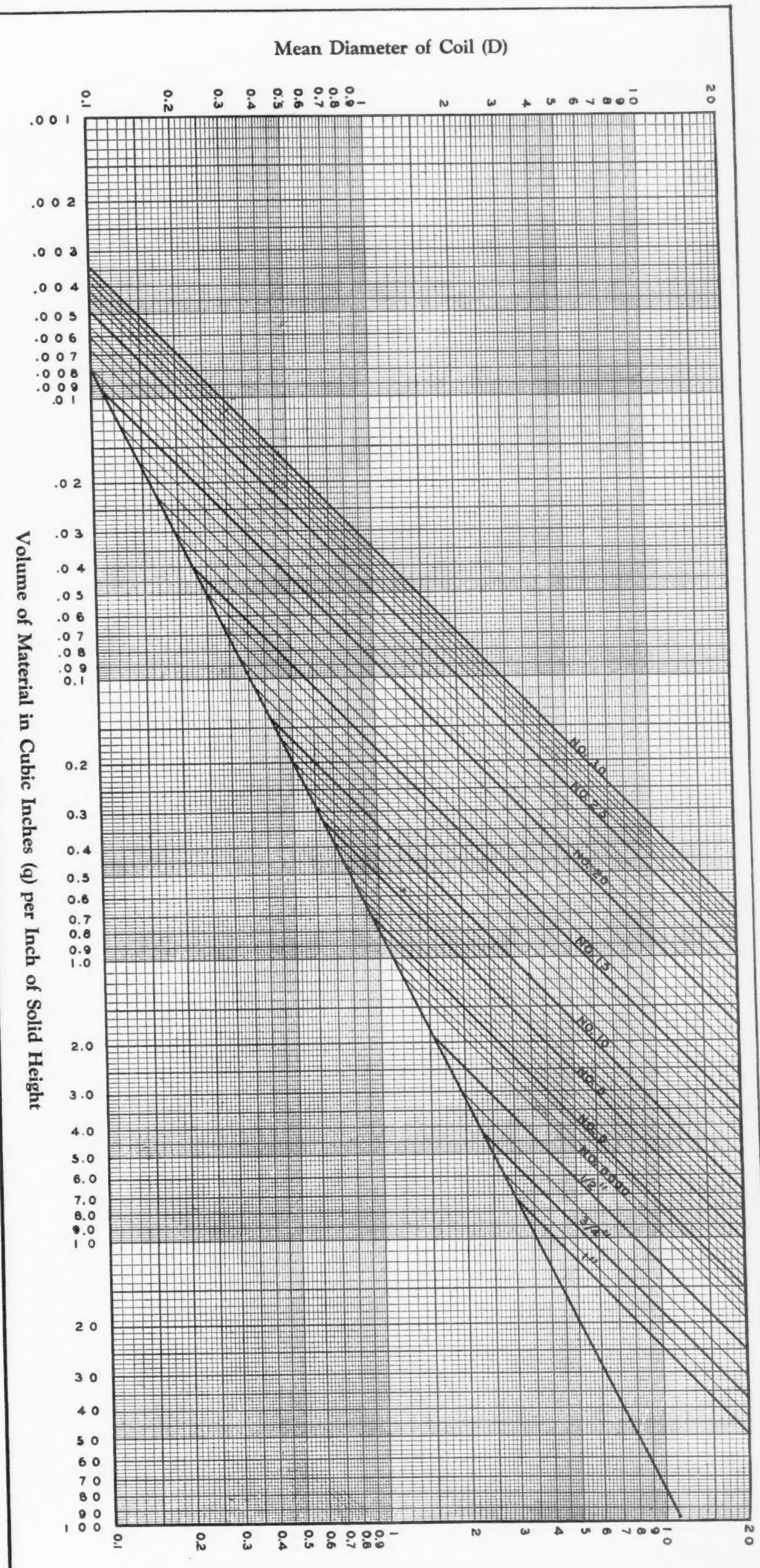


Fig. 1. Chart for Finding Weight of Helical Springs made from Circular Section Wire, Washburn & Moen Gage Sizes

$Q = 1.7 \times 2 \times 0.288$
$= 0.979$ pound

For the third spring (3), we have $q = 2.3$, according to the chart Fig. 1. For this spring we have,

$Q = 2.3 \times 1.5 \times 0.288 = 0.990$ pound

Example 2—A spring coiled from No. 10 Washburn & Moen gage wire has a mean diameter $D = 1.115$ inches and a solid height of 3 1/2 inches.

Referring to the chart Fig. 1, we find that the volume of material, in cubic inches per inch of solid height, is 0.37. We, therefore, have,

$Q = 0.37 \times 3.5 \times 0.288 = 0.373$ pound

Example 3—A spring is coiled from No. 8 Brown & Sharpe gage phosphor-bronze wire. The mean diameter $D = 0.622$ inch and the solid height $SH = 2$ 1/2 inches.

Referring to the chart Fig. 3, we find $q = 0.2$. Thus we have,

$Q = 0.2 \times 2.5 \times 0.321 = 0.16$ pound

Example 4—A helical spring made from 1/4-inch square steel wire has a mean diameter of 2.06 inches and a solid height $SH = 4$ inches. What is the weight of the spring?

Referring to the chart Fig. 2, we find that the volume of material, in cubic inches per inch of solid height, $q = 1.65$. As the factor M for steel $= 0.288$ we have,

$Q = 1.65 \times 4 \times 0.288 = 1.90$ pound.

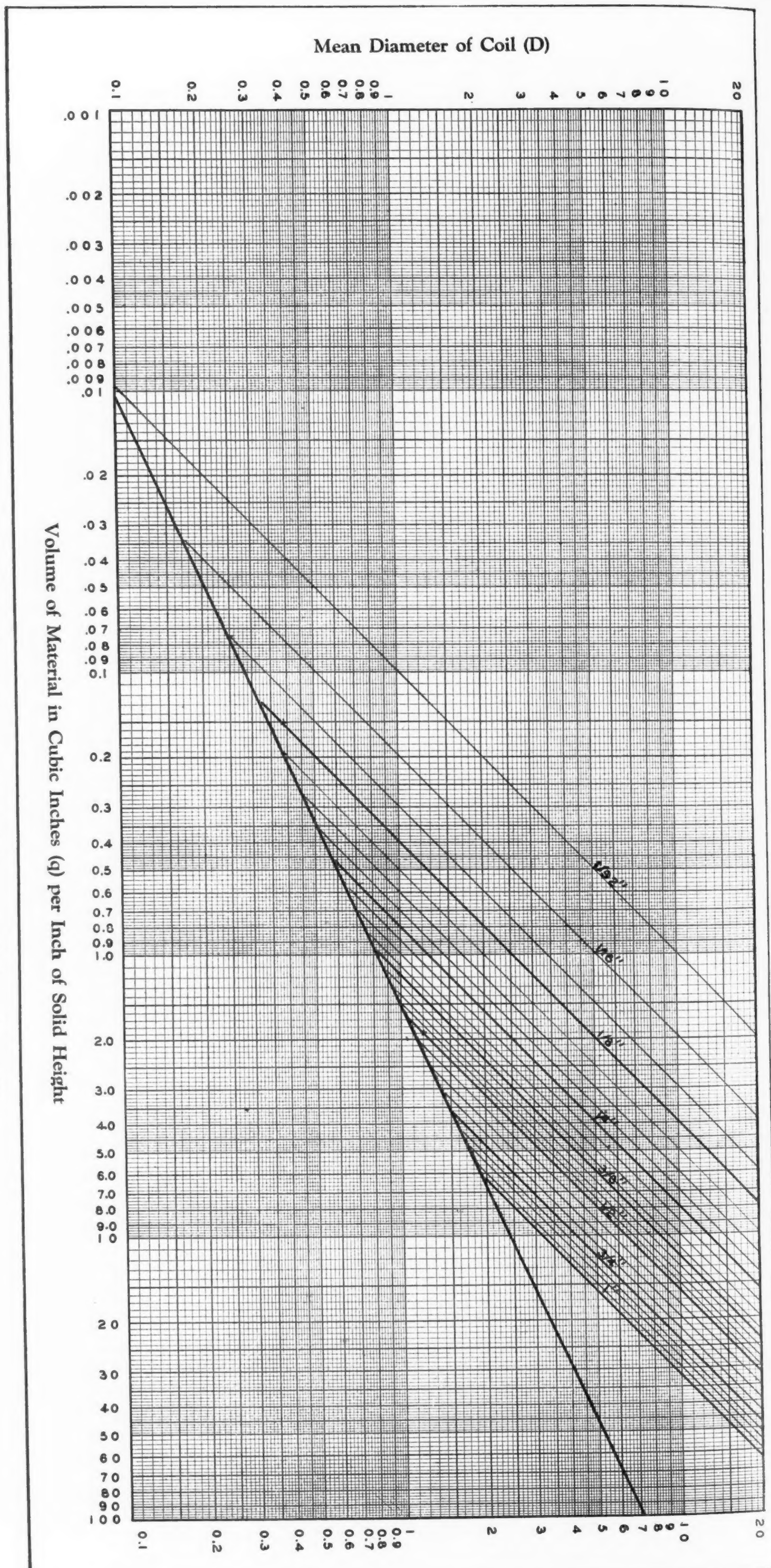


Fig. 2. Chart for Finding Weight of Helical Springs made from Square Wire

POWER TRANSMISSION MEETING

A Regional Meeting of the Power Transmission Association, having headquarters at the Drexel Building, Philadelphia, Pa., was held in Philadelphia April 1. W. H. Fisher, president of the association, presided. Mr. Fisher gave a brief review of the activities of the association at the present time and of the plans for the future. T. E. Hazell, vice-president of the William H. Taylor Co., Allentown, Pa., and a member of the Dealers' Relations Committee, gave an interesting talk on the distributor's place in the power transmission field. William Staniar, consulting engineer of the association and chairman of the Board of Advisory Engineers, opened a discussion on belting practice from the maintenance and production point of view. Wilbur J. Peets, chairman of the Executive Committee of the Machine Shop Practice Division of the American Society of Mechanical Engineers, added some valuable ideas to the discussion.

* * *

A manufacturer of light automobile trucks equipped with high-speed engines is using a chrome-nickel alloy iron in the cylinder blocks. This is claimed to increase the life of the engine many times, due to the resistance of this material to wear. As valve seat wear is diminished, less valve grinding and tappet setting are necessary.

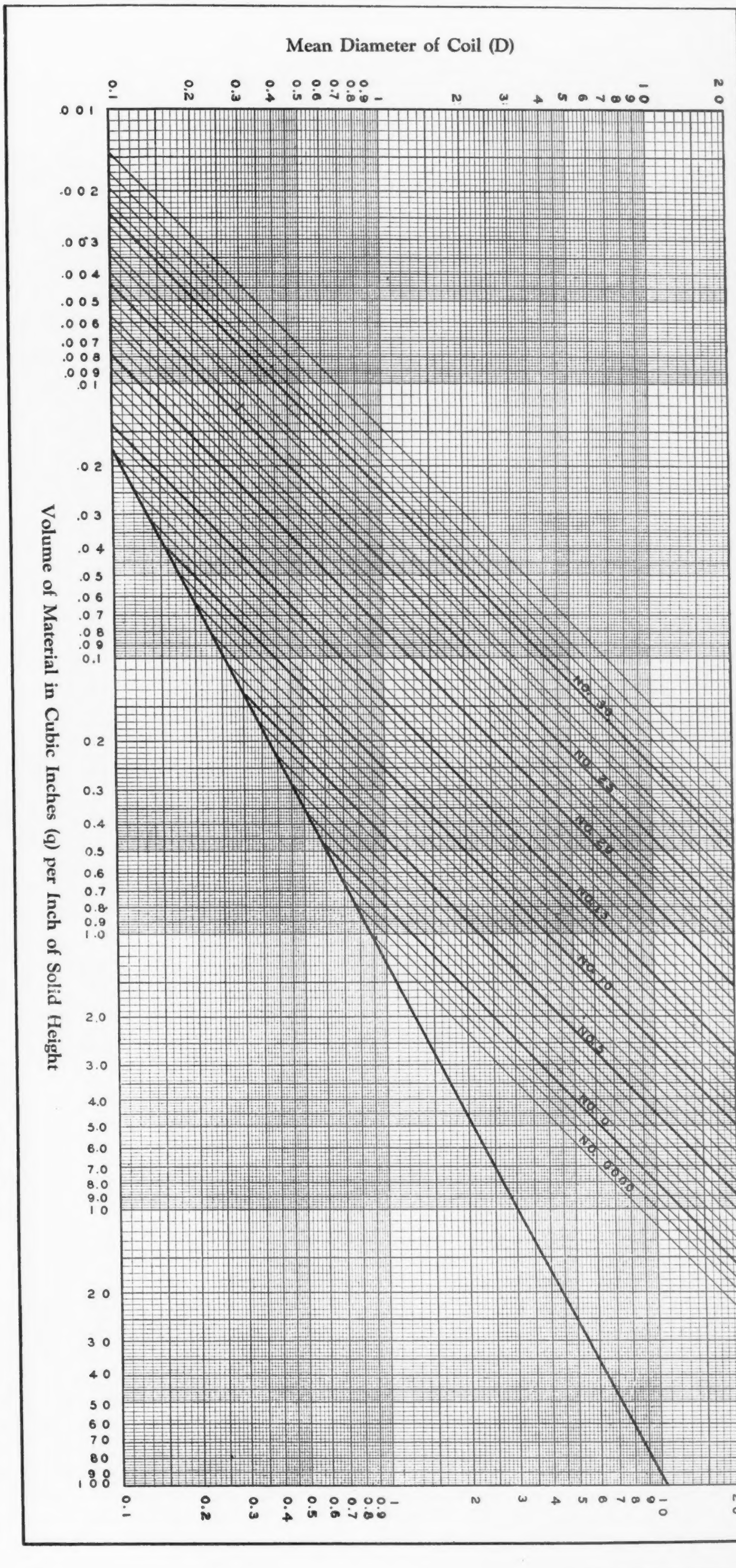
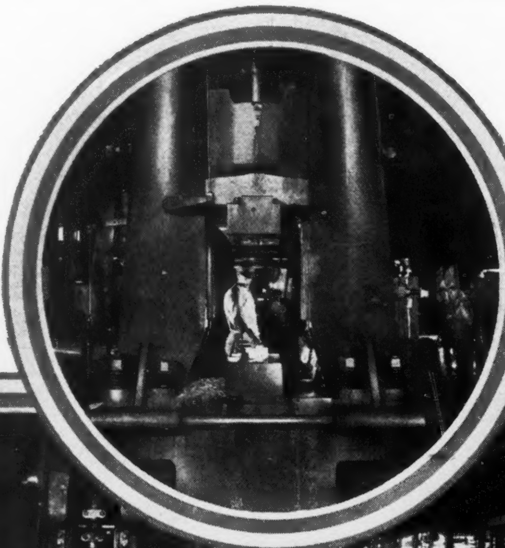


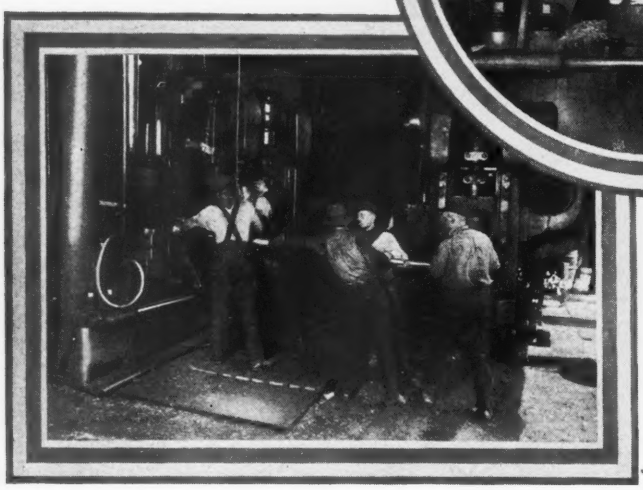
Fig. 3. Chart for Finding Weight of Helical Springs made from Round Wire, Brown & Sharpe Gage Sizes

Notes and Comment on Engineering Topics

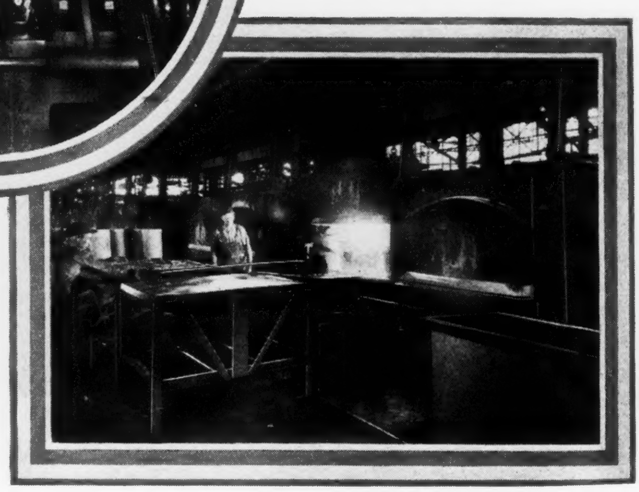
Fog, the enemy of aviation, is penetrated to a remarkable extent by the powerful beam of light which is projected by a new form of airport beacon developed by the National Lamp Works of the General Electric Co., one of which has been erected at the Cleveland Municipal Airport. Pilots have commented favorably on the new beacon from the standpoint of fog penetration and long-range visibility. It is also valuable as an airport marker, because incorporated in the design is a fan of light, half of which is white and the other half red. The rotation of the light produces alternate red and white flashes enabling the aviator to distinguish the airport from brightly lighted parks, railroad yards, or streets.

The illustration in the circle shows the forging of a Chevrolet crankshaft from straight bar stock. The huge three-ton hammer is one of a large battery used exclusively for this purpose. Below is shown another section of the Chevrolet forge plant, where approximately 130 power hammers are used in the forging of Chevrolet parts.





In the illustration below is shown one of the many batteries of carburizing furnaces that are required to obtain the daily production of the tens of thousands of heat-treated steel parts used in the manufacture of Chevrolet cars. The temperatures are automatically controlled in order to insure uniformity in the heat-treatment of the steel.



An alloy of copper and cadmium, containing about 1 per cent of cadmium with the remainder copper, has been used for trolley wires on street car systems with considerable advantage. Tests show that the life of this alloy wire is from two to three times that of the best hard-drawn pure copper wire. The 1 per cent of cadmium raises the tensile strength of the material from 29 to 50 tons per square inch without materially affecting the conductivity.

The Aeronautic Division of the American Society of Mechanical Engineers has announced three annual prizes to students of engineering for the best papers to be submitted on civil aeronautic subjects. The prizes have been established to stimulate students to give more serious consideration to the problems facing the aeronautic industry. The papers submitted need not be prepared especially for the contest, but may be either a graduating thesis or a paper prepared for some meeting of the Society; but it must not have been previously contributed to or published by any other society or technical publication. Complete information relating to the student aeronautic prizes may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

According to W. H. Rastall, chief of the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., the United States produces 57 per cent of the world's industrial machinery. Great Britain and Germany, each, produce about 13 per cent of the total. These two countries are the most important competitors of the United States in industrial machinery in foreign markets, but at the same time they are also the most important customers of this country. Great Britain, alone, absorbs about $25,000,000 worth of American industrial machinery annually; Germany absorbs about $7,000,000 worth, and would take more if financial conditions in that country made this possible.

QUICK-ACTING CLAMP WITH CAM LOCK

By E. F. EBERHARD

The quick-acting clamp shown in Figs. 1 and 2 is incorporated in a milling fixture. It is so designed that when the lever *B* is swung from the left- to the right-hand position, the clamp *C* is advanced from the position shown in Fig. 1 to that shown in Fig. 2, and forced down with sufficient pressure to hold the work in place. The reverse movement of the lever serves to release the clamping pressure and return the clamp to the position shown in Fig. 1, so that the work can be removed.

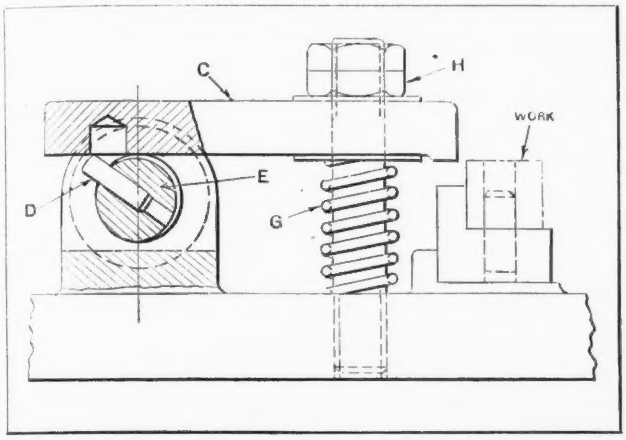


Fig. 1. Quick-acting Clamp in Open Position for Removal of Work

The operation performed on the work consists of facing the ends simultaneously with a straddle type milling cutter. The forward movement of the clamp is produced by the pin *D*, Fig. 2, which engages the side of the drilled hole in clamp *C*, carrying the clamp forward into the position shown in Fig. 2 when the handle is moved from left to right. The pin *D* is set in the camshaft *E*, to which the lever *B* is attached. The position of the eccentric or cam portion of shaft *E* is such that it raises the outer end of clamp *C* near the completion of the right-hand movement of lever *B*. The spring *G* serves to keep the clamp *C* in contact with the washer under the lower locknut *H*. The work is located on the fixture by the pin *I*.

* * *

DETROIT AERONAUTIC MEETING

The Detroit Section of the Society of Automotive Engineers staged an Aeronautic Meeting in Detroit, April 9 and 10, at which many interesting papers were read. The Detroit Aircraft Show was visited, and the presentation of the Wright Brothers Medal was made at a dinner on April 9 at the Book-Cadillac Hotel. A general standardization conference was also held, as well as meetings of the Society of Automotive Engineers' Aircraft Engine Division and Aircraft Division.

INVESTIGATIONS OF WIRE-ROPE LIFE

The study of wire rope and the factors governing its life is being undertaken by a research committee of the American Society of Mechanical Engineers under the sponsorship of the Engineering Foundation. A large number of wire-rope manufacturers and users have agreed to support the investigation, which is being conducted on a large scale. The plans include the construction of a testing machine for wire rope, which can be used to reproduce all the varied service conditions to which such rope is subjected.

Miles of wire rope are used every year in construction work, oil wells, mines, elevators in buildings, and in industrial plants for many services that affect the safety of lives and property. Users of such ropes have found, however, that their life varies greatly and for no clearly understandable reason. Even in elevator installations where the conditions of service are well known and the cables carefully cared for and inspected, there is a wide variation in life. In several such installations, investigation has revealed that some of the cables have had three times the life of others, although all were operated under the same conditions, and made of the same material and by the same manufacturer. Because of the disaster resulting from failure, many ropes are, therefore, discarded long before the end of their useful life. In the oil fields, in mines, and on construction work where the conditions of service are extremely varied and severe, the life of wire rope is highly problematical. Some research has been carried on to collect the needed information, but there is still much data lacking.

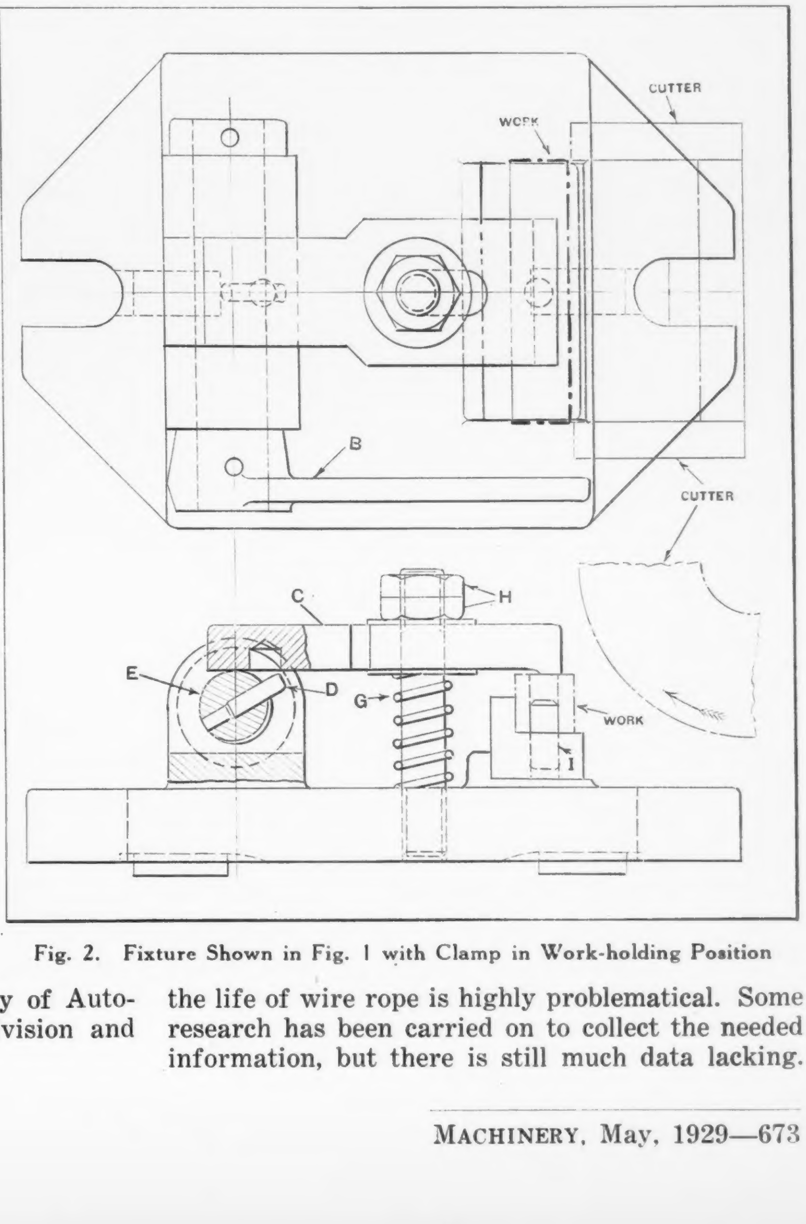
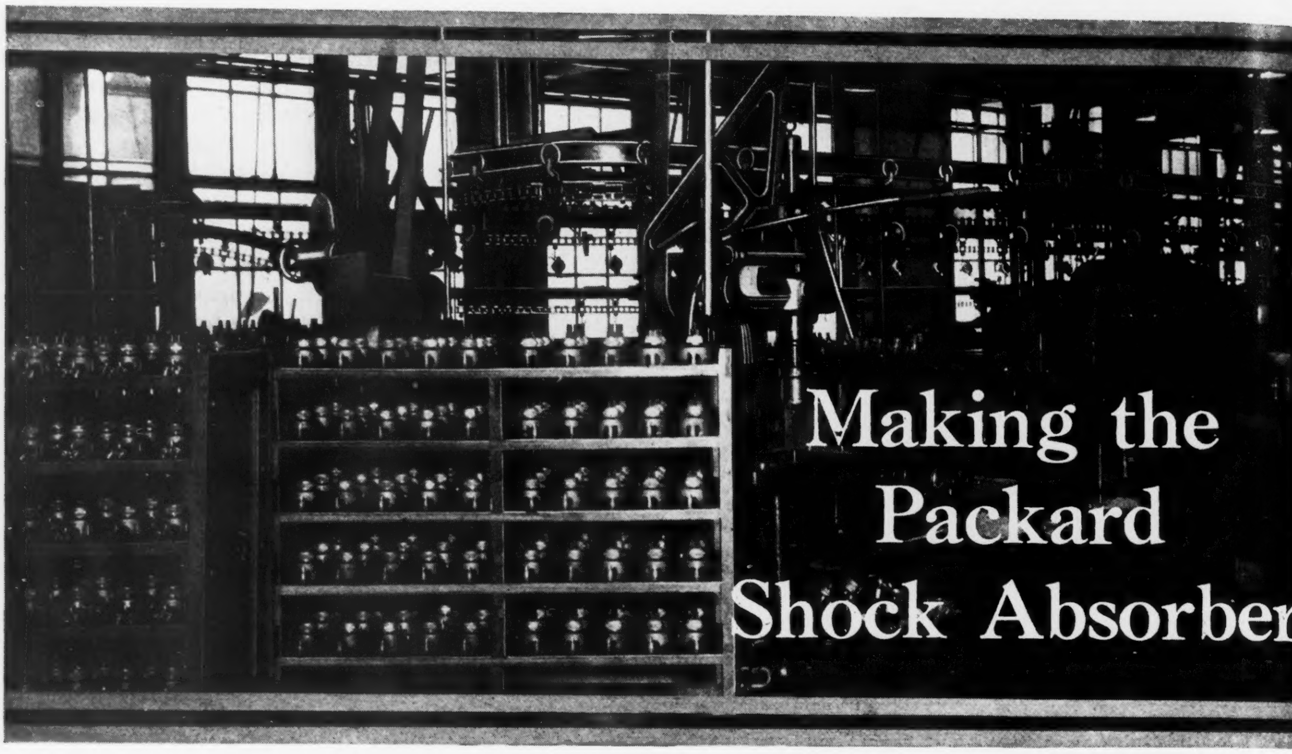


Fig. 2. Fixture Shown in Fig. 1 with Clamp in Work-holding Position



Making the Packard Shock Absorber

Producing One Thousand Shock Absorbers per Day—Seventy Operations are Required on Each, Exclusive of Forging, Stamping, and Assembling

By CHARLES O. HERB

AUTOMOBILES manufactured by the Packard Motor Car Co., Detroit, Mich., are now equipped front and back with hydraulic shock absorbers made in the plant of the company. These units are produced in a separate machining department recently established and provided throughout with up-to-date types of machine tools and other equipment. One thousand shock absorbers per nine-hour day is the production for which the department is tooled. Approximately seventy operations are involved in machining the different shock absorber parts, not to mention the numerous forging, stamping, and assembling operations and inspections. Many of these machining operations possess features of unusual interest; typical ones will be described in this article.

Shaping and Grinding Shock Absorber Camshafts

An important part of the shock absorber is the camshaft *A*, Fig. 2. There are two unusual operations involved in finishing the cylindrical part of the camshaft that is opposite the cam or sector. These operations originally presented difficulties due to the necessity of finishing the cylindrical surface to the corners formed by the sector sides. The first operation on this surface is performed in a Fellows high-speed gear shaper equipped as illustrated in Fig. 1. In this operation, the camshaft is held between centers as shown at *A*. The work is located radially, with respect to the cutter, by means of block *B*, which is pushed into position close to the curved part of the sector. This block has equalizing fingers on each side which grip the sides of the sector. It is fastened to a finished lug which is integral with the faceplate attached to the work-spindle. Thus, as the work-spindle indexes between the reciprocations of cutter *C*, the work is also indexed through locater *B*.

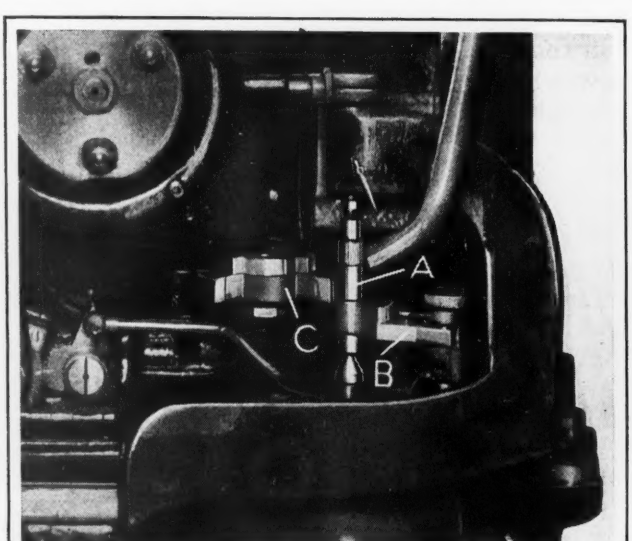


Fig. 1. Machining a Cylindrical Surface on a Shock Absorber Camshaft, in a Fellows Gear Shaper

Cutter *C* has the cutting edge on the bottom, and therefore functions on the down stroke. It reciprocates at a high rate of speed, indexes with the work, and machines into the corners formed where the sides of the sector join the cylindrical surface.

Grinding of the cylindrical surface on each side of the cam sector, after the part has been hardened, is done in the special machine illustrated in Fig. 2. The necessity of grinding the surface into the corners formed by the sector obviated all chance of doing this operation in a cylindrical grinding machine.

The part is mounted between centers for the operation, as illustrated at *B*, after a driver *C* has been first assembled on one end of the camshaft that has been previously tapered and serrated. Driver *C* is, of course, tapered and serrated to suit. It is driven by a stud extending upward from the top of the conical faceplate *D*.

This operation is performed as slide *E* reciprocates, carrying the work vertically past the grinding wheel; the work is indexed approximately fifteen degrees before each up stroke of the slide. The cylindrical surface of the camshaft is ground to size within a tolerance of 0.001 inch. Dressing of the grinding wheel edge to the same radius as the work surface being ground is accomplished with a diamond mounted in a holder which is placed between centers in the same manner as the work. The wheel is 3/8 inch thick. Two motors are provided on the machine, one for driving the grinding wheel and one for supplying power for the reciprocating and indexing motions of the work. The machine stops automatically as each operation is completed.

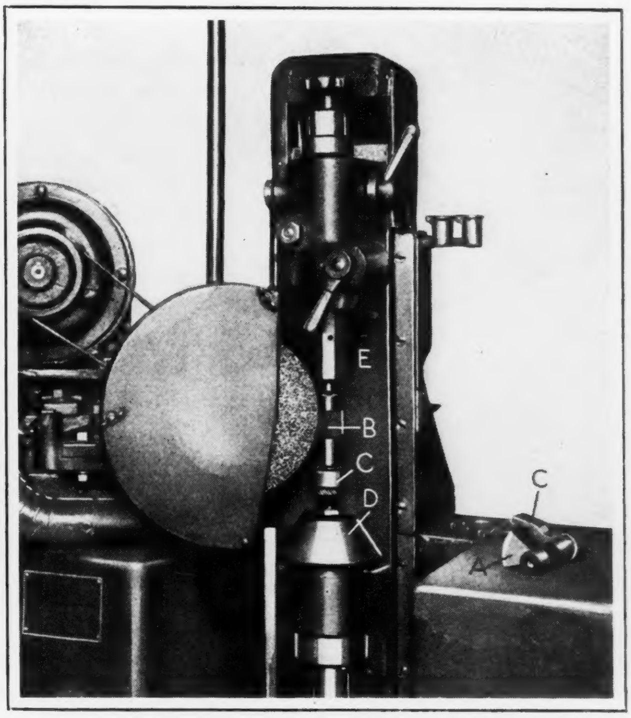


Fig. 2. Unusual Grinding Operation on a Cylindrical Surface Necessitated by a Lug on the Part

Broaching and Tapering Shock Absorber Levers

The tapered and serrated end of the camshaft, when assembled into the shock absorber unit, fits a corresponding hole in a lever, two examples of which are shown at *A*, Fig. 3, in position for a broaching operation. This operation consists of simultaneously producing the serrations in the two levers by pushing broaches *B* through them. Each lever is located properly by slipping the taper-reamed hole in the small end over a hardened and ground plug contained on the corresponding block *C*. Both of these blocks have a second plug *D* which locates another longer lever of offset design. The hole broached during this operation is about 1 inch in diameter, while the serrations are of the V-type with an included angle of 90 degrees. They are 0.041 inch deep at the large end of the hole and 0.0392 inch at the small end. The broaching press has a power feed.

Fig. 4 shows a power press equipped for swaging the serrated hole in the shock absorber lever to make it tapered. The hole is about 3/4 inch long and is tapered to an included angle of slightly more than 3 1/2 degrees. After the lever has been located beneath the press ram, as shown at *A*, by slipping the taper-reamed hole in the small end over a locating plug, as in the preceding broaching operation, a tapered and fluted mandrel *B* is entered loosely into the flutes in the hole to be expanded. Then the machine is operated and the ram descends, forcing the mandrel part way into the work; the connecting-rod of the press is so adjusted that pressure is exerted on the mandrel at the tail end of the stroke, pushing it through the desired distance only. As the mandrel wears, the connecting-rod is adjusted to lower the press ram a corresponding amount.

While one shock absorber lever is being swaged as described, the mandrel, which has previously been forced into a second lever, is removed from

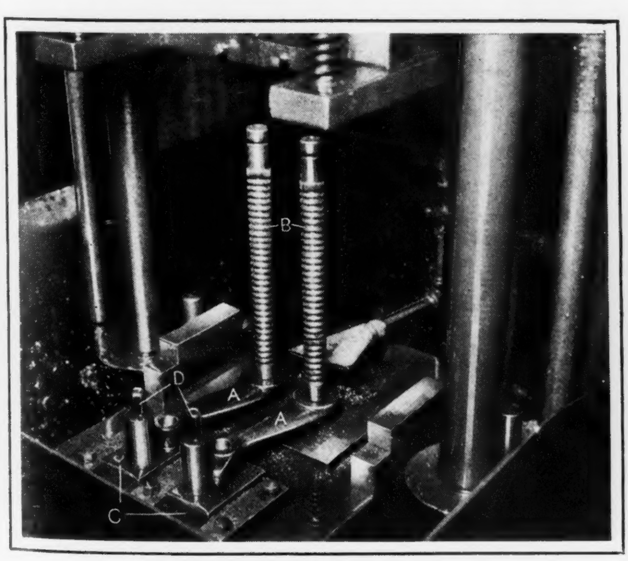


Fig. 3. Simultaneously Broaching Serrations in a Hole in Two Shock Absorber Levers

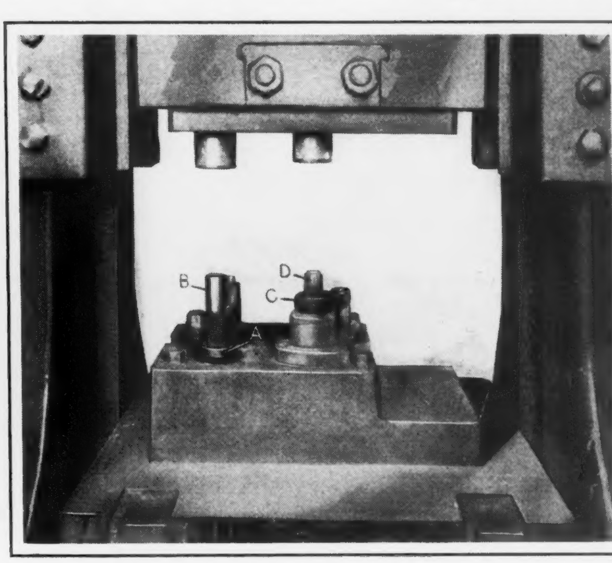


Fig. 4. Swaging the Serrated Hole of Shock Absorber Levers to a Taper

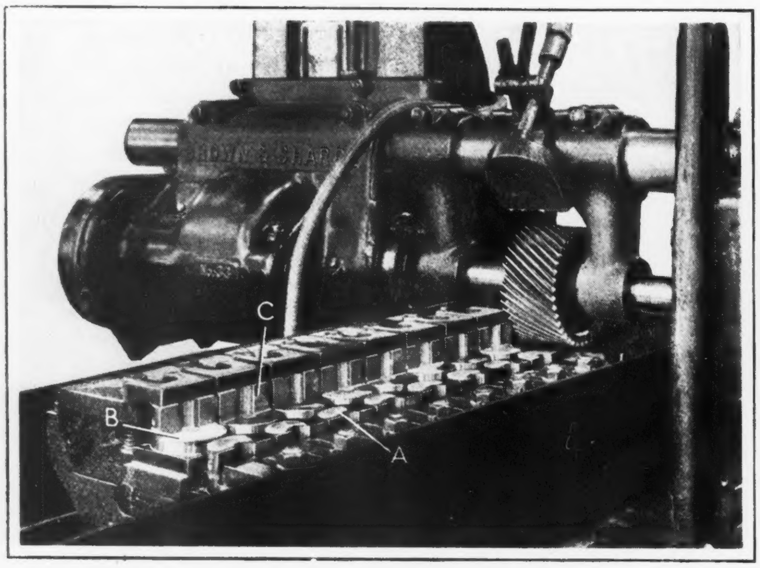


Fig. 5. Milling Operation in which Two Surfaces of a Part are Milled to Height within a Tolerance of 0.001 Inch

placed in the jig with the upper side uppermost, as shown at *A*, two with the closed side uppermost, as illustrated at *B*, and two in a sidewise position, as illustrated at *C*. Only one of the bodies is shown in position with the closed side uppermost; the second of these is placed on dowel-pins *D*.

After the jig has been loaded, the parts are indexed into position under one group of spindles, then under a second group, and finally are returned to the front of the machine for reloading, two parts out of each group of six being completed at every indexing of the jig. It will be understood that each part must make three passes around the machine, and between these passes must be placed in the different positions.

The machine is equipped with sixteen spindles, four of which carry drills, four spot-facing tools, and four reamers for machining the bolt holes in the bodies. Two spindles carry drills, and two countersink tools for producing oil-filler holes. The various tools are guided by bushings in a plate *E*, which is lowered and raised with the drill-head. Simple clamping means are furnished for accurately holding the bodies in the different positions.

that part. The second lever is placed beneath the press ram in the reverse position, illustrated at *C*, with the shank of mandrel *D* extended into the socket of a cylindrical block. The small hole in the offset end of the lever is again located over a plug. When the press ram descends, forcing mandrel *B* into lever *A*, obviously mandrel *D* is pushed from the lever into which it previously was forced.

One important factor in the success of this taper-swaging operation is the use of plain white lead in oil on the mandrels, as a lubricant. This material has been found to adhere better to the mandrel than oils alone. It is later thoroughly washed from the work by means of a kerosene solution.

Milling Parts to Length within a Tolerance of 0.001 Inch

Sixteen shaft bearings are milled simultaneously in the operation shown in Fig. 5. Each part is traversed twice under the milling cutter, first while positioned in the front row, and second while clamped in the back row. During the first traverse, the surfaces *B* and *C* of the shaft bearing are milled, and in the second pass surface *A*. When the parts are removed from the fixture, the height between top *A* and shoulder *B* must be true to size within plus or minus 0.0005 inch, the specified dimension being 1.1875 inch. About 1/64 inch of stock is removed from each of the three surfaces.

Every piece is held on hardened and ground blocks by an individual clamp of simple construction, and suitable locating means are provided. The cutter is 7 inches in diameter and about 4 inches face width. The parts are drop-forgings, made of S.A.E. 1020 steel.

Jig that Holds Twenty-four Parts at a Time

Twelve shock absorber bodies are machined simultaneously in the operation illustrated in Fig. 6, in which a four-station jig is employed. The jig holds twenty-four parts at one time, six in each quarter of the jig. Two of these six parts are

"Planamilling" and Diamond Boring Operations

On the inside, the shock absorber bodies have a bore that is milled to a diameter of 3.250 inches, within plus or minus 0.0005 inch, and a face at the closed end that must be finished at right angles to the bore within an extremely close tolerance. This face, also, must have a very smooth finish. The two surfaces may be observed at *A* in Fig. 7, which shows the Hall "Planetary" milling machine used in finishing them. They are finished simultaneously by the use of a single cutter, of solid construction, with spiral fluted teeth on the periphery, as well as face-milling teeth on the front end.

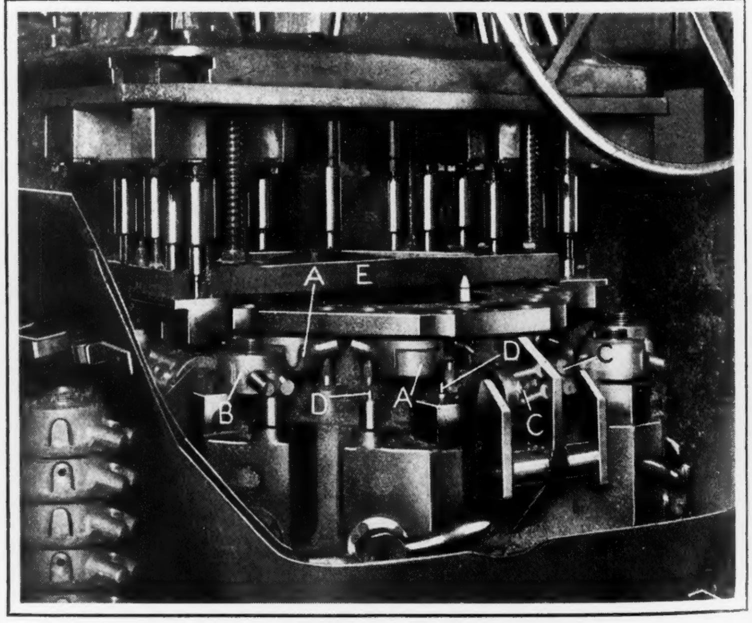


Fig. 6. Multiple-spindle Drilling Machine Equipped with an Indexing Jig of Unusual Design

When the machine is started, the cutter, while rotating on its axis, makes a planetary movement inside the work, and also advances a slight amount axially, so as to reach the desired depth of cut on the internal face. From 0.008 to 0.012 inch of stock is removed from each surface. Cutting oil is supplied copiously to the cutter during the operation to wash out all chips and keep the cutter and work cool. The oil is prevented from splashing on the machine and operator by a closed nut, which is screwed on the external threads of the boss that surrounds the small hole in the center of the body, before the body is placed in the machine.

Each body is accurately located by seating a previously machined shoulder on a narrow rim of the machine fixture. Three clamps actuated through the pneumatic cylinders *B* exert pressure on the body, holding it securely to the faceplate of the machine during the milling. At the end of the operation when the air pressure in the cylinders is reversed, these clamps are instantly released. The shock absorber bodies are drop-forgings of S.A.E. 1020 steel.

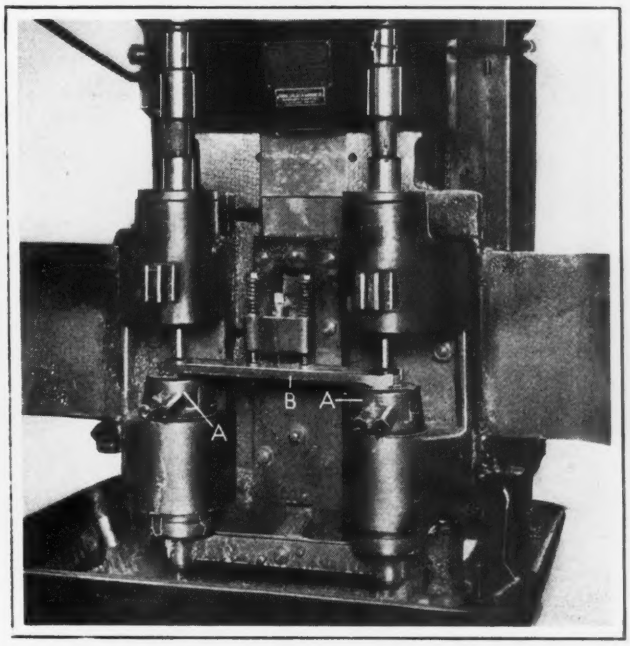


Fig. 8. Diamond-boring Two Shock Absorber Bodies at One Time

Diamonds are used for boring the bronze bushing in the small hole at one end of the shock absorber bodies, this operation being performed in the machine illustrated in Fig. 8, from which it will be seen that two bodies *A* are bored simultaneously. It is important that the small hole in the body be concentric with the large bore within 0.001 inch, and the diameter must be true to the specified size of 1 inch, within plus or minus 0.0002 inch. For this operation, the bodies are located from the large finished bore, and are automatically clamped by bar *B*, which descends with the diamond boring heads, and returns with them when the operation is finished.

Conveyor Speeds up Assembling and Inspecting

Before going to the inspecting and assembling benches, the various parts of the shock absorber are attached to an overhead conveyor, seen in the heading illustration, and carried through a washing machine, which thoroughly cleanses them from oil, chips, and dirt. They are dried as they leave the washing machine and are delivered by the conveyor to the inspectors. At the inspection bench, among other interesting checking devices, is a three-dial fixture used for inspecting the bore of the shock absorber body and the internal face, which are machined simultaneously in the "Planetary" milling machine as described. One of the indicator spindles rests on the large bore, one on the small bore, while the third spindle rests on the internal face.

As the inspectors finish their checking, the parts are again fastened to the overhead conveyor and carried to the different assemblers, who once more place the assembled units on the conveyor to be carried to welding machines for an operation that will be described later; they are then carried, in turn, to leakage testing equipment, resistance testing apparatus, and several other machines where minor operations are performed. This overhead conveyor installation saves considerable space and speeds up production materially, since the various operators are obliged to time themselves in accordance with the delivery of parts by the conveyor.

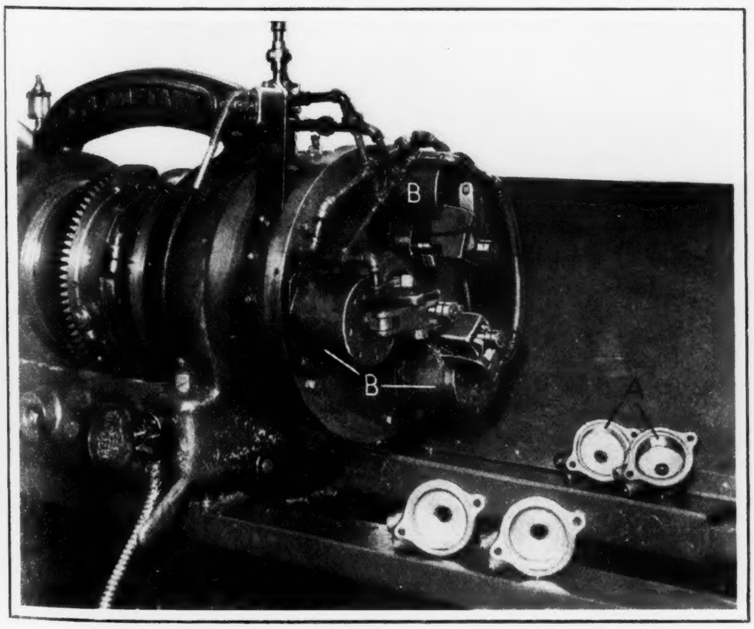


Fig. 7. "Planetary" Milling Operation in which a Bore and an Internal Face are Milled Accurately in Relation to Each Other

Welding the Assembled Units

After various parts have been assembled in the shock absorber body, a stamped steel shell having a turned-up edge that fits into the slight recess in the open end of the body, is welded to the body to enclose the parts. This operation provides an oil-tight assembly of the shock absorber unit. Later the unit is subjected to a test in which oil at a pressure of 500 pounds per square inch is forced into it, and there must be no sign of leakage. Before the welding operation, the steel shell is driven into the body with a brass hammer, the fit being a close one.

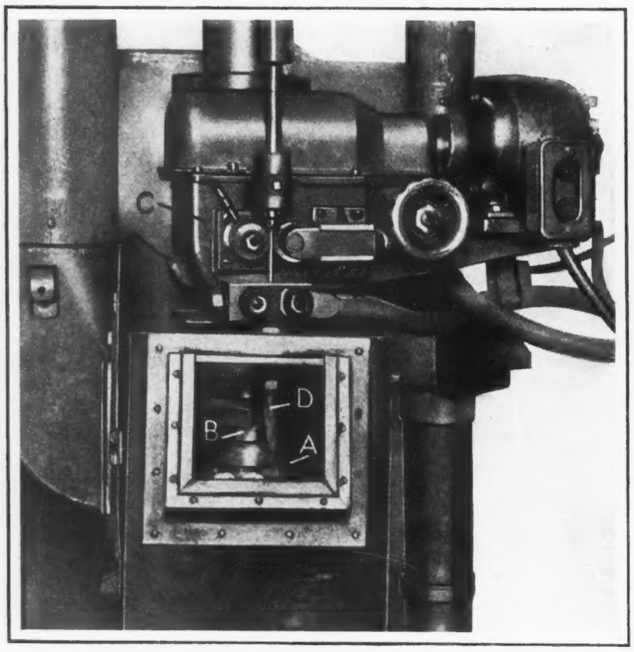


Fig. 9. Welding Operation which Completes the Assembly of the Shock Absorber Units

Welding of the two parts is accomplished with rapidity in special machines of the type illustrated in Fig. 9. The body, which is seen at *A*, is seated on a spindle-nose equipped with two dowel-pins over which the bolt-holes in the body are slipped for driving purposes. The body hub and shaft extend into the spindle. A clamp *B* exerts a slight amount of pressure on the shell which is to be welded to the body. The operation is performed by means of a General Electric automatic welding head, located at *C*, which feeds electrode wire to the parts through holder *D*. As the electrode wire is fed, the machine spindle makes a complete revolution, carrying the shock absorber body and shell beneath the electrode. The machine, after completing the cycle, stops automatically. A production of one welded unit per minute is averaged, the diameter across the weld being 3 1/8 inches. Type B electrode wire, 3/16 inch in diameter, is used.

As soon as the welded assembly is removed from the machine, it is dropped into an oil bath in which the oil is kept cool by being constantly circulated through cooling apparatus. Later the weld flash is machined off the assembly to obtain a neat appearance. Although each shock absorber is submitted to the severe leakage test previously referred to, rejections because of unsatisfactory welding are rare.

* * *

Commerce Reports statistics on the Canadian machinery industry for 1927, just available, show that in that year the Canadian production was valued at $44,602,000, the highest on record for that country. This is a 16 per cent increase over 1926 and 10 per cent over the previous high record of about $40,500,000 established in 1920. There are 160 manufacturers of machinery, of which 116 are located in Ontario and 27 in the Province of Quebec. These manufacturers employ nearly 10,000 people. Pulp and paper mill machinery lead all other industrial machinery items. The output of metal-working machinery is valued at $1,363,000.

CONVERSION OF A PLANER INTO A GRINDER

By DONALD A. HAMPSON

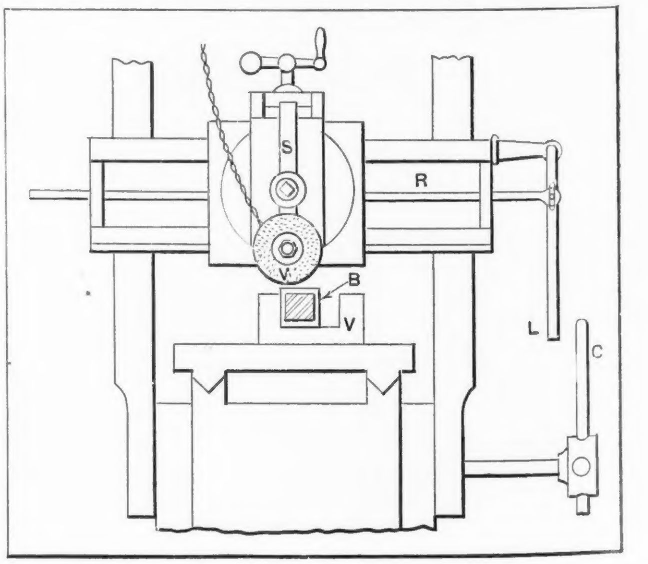
In a plant manufacturing broaching equipment, there are a number of planers that have been converted into grinders for sharpening broach teeth. The essential features of the converted machines are shown in the accompanying illustration. A square broach is shown in section. The length may be 4 or 5 feet, or much less. After hardening and tempering, the broaches are revolved on centers to determine whether or not they are true. Some straightening is always necessary, which is done by small arbor presses, with the broach raised to the temperature of melting solder.

Means are provided for supporting the work either at intermediate points or throughout its entire length. The broach *B* shown in the illustration rests against the bottom and one side of the vise *V*, which is secured to the planer table. The power employed in the sharpening process is furnished by the motor of the toolpost grinder, which is connected with a socket of the lighting circuit.

The machine pulley through which the traverse of the table is ordinarily obtained is replaced by the capstan wheel *C*, which is employed for indexing the work as required for grinding successive teeth. The length of the arc through which the outer ends of the long handles of wheel *C* pass when indexing the work the comparatively short distance of a tooth space, enables the operator to gage the spacing quite accurately.

Grinding is done by the wheel *W*, held between the flanges of the toolpost grinder, whose shank is indicated at *S*. Vertical movement is through the usual hand feed, while such tilting as may be desirable is accomplished at the toolpost.

Since the length of cut varies, and thousands of teeth must be ground in a day's time, some easier method of moving the head was imperative. Accordingly, the screw was removed and a rod *R* substituted, which is actuated by the lever *L*. Both *L* and *C* are within convenient reach of the operator, so that he is able to grind across a tooth and index the table to the next one in a minimum of time. The taper is obtained by setting the broach so the teeth on top are parallel to the table.



Planer Converted into a Grinder for Grinding Broaches

What MACHINERY'S Readers Think

Brief Contributions of General Interest in the Mechanical Field

BUILDING FROM WITHIN

I read with keen interest your editorial "Building from Within." One of the first requirements in developing a man is always to tell him what you want done; occasionally, why you want it done; but seldom, how you want it done. If you lead a man step by step in doing something, he generally does not grasp your objective, but simply follows blindly along as he is led. If you apply this to all the men under your supervision, you have only one mind working instead of the sum total of the minds of all your men; hence, best results are obtained by telling a man clearly what one wants done, and then encouraging him to work out the details for himself.

Again, if there is a dispute about a certain job, let the man who did the work be present, if possible, while the subject is argued out. Not only does this give him a chance to explain, and possibly defend himself, but it is a fine opportunity to broaden his viewpoint. Bringing the man who did the work along to explain the job is not a confession of lack of knowledge on the part of his supervisor. It is a means of developing men to share responsibility.

LEWIS J. YAPP

ARE THERE TOO MANY CONVENTIONS?

Despite the force of the implied arguments in the article on page 491, March MACHINERY, I would answer the question raised about conventions in the negative. If, in questioning the value of conventions of trade associations and engineering societies, major stress is laid upon the importance of a highly constructive program, the really big point of the value of a convention is missed. The formal program should, of course, be interesting enough to attract attendance, and the discussions that bring out opinions and additional information are often more valuable than a formal paper; but more important than all this, and the real reason for conventions, may be summed up in the word "contacts."

The engineer or executive who is trying to obtain the facts and figures behind what takes place in the industrial field would have to travel great distances and visit many plants if he were to collect the information and make the contacts and acquaintances that he can make at a single convention. There he meets with a group of men, gathered around a luncheon table or in a hotel lobby, who bring one another ideas from all parts of the country. It is in these unrecorded minutes of the convention that its real value lies. The man who feels that a convention that he is attending is not worth while should not look to the program committee for correction, for it is almost certain that he is missing out on the value of the informal gathering.

N. C. RICHARD

Referring to the article on page 491 of March MACHINERY, I believe that the greatest advance in American industry in recent years, from a business point of view, has been due to the cooperation between manufacturers in the same lines of industry. Trade associations and engineering societies have had a tremendous influence on the development of improved business and engineering methods. Conventions broaden a man's outlook through contact with others, by giving him an idea of the way in which problems similar to his own are being met in other parts of the country. To many men, it is their only direct outside contact.

In favor of conventions it may be said that the same principles obtain as in the case of the man who travels and meets changing conditions and all manner of people, as contrasted with the man who lives all his life in one locality. It cannot fail to be of value to the man in the Middle West, let us say, to know the conditions that obtain for a product similar to his own in the Far West or on the Eastern Coast. He is better able to meet the questions and objections of the purchasers of his own product in those sections of the country. He gains vision and adds to his selling ideas by talking with men who are marketing a similar product under different conditions. Conventions and meetings can be made to serve such distinctly constructive purposes that every man will come away from them feeling that he can do his own work better in the future because of having attended the conference. There can never be too many meetings and get-togethers of the constructive type for the stimulation and encouragement of industry.

FREDERICK KAMPMEIR

SHOULD TOOL DESIGNERS MAKE THEIR OWN DRAWINGS?

I believe that tool designers should make their own drawings. The difference between success and failure in a design often depends on a minute detail. For example, a chip under one leg of a three-legged drill jig, not easily detected, may throw it out of alignment sufficiently to spoil the work. Four-legged tools overcome this difficulty, because they rock and expose the trouble. Also a slight error in detail may often cause a whole tool to be scrapped.

A practice that is fortunately passing is to have the tool designer work in the tool-room, rather than in the main drafting-room. This leads to many things being omitted from the drawings, because it is so easy for the designer to make verbal explanations. Hence, the records of tool design and the drawing files become incomplete, and when a new man, unfamiliar with the unrecorded tradition, starts to work, the system breaks down completely.

Therefore, it is best to let the tool designer complete his job as a regular drawing. It may cost a little more at first, but will prove cheaper in the long run.

EARL L. FAIRALL

The larger concerns today realize that time is wasted in having one man design a tool or fixture and then turn it over to a detailer to make detail drawings. Also, the practice of making ink drawings is gradually giving way to the present method of designing the tool and making the finished drawing directly on pencil tracing cloth. Tool draftsmen are not divided into design and detail men to the same extent as formerly, but each man frequently designs the tools and makes his own finished drawings.

The procedure in planning the entire work is as follows: One man, called the "lay-out man," will make a general study of the complete tooling equipment and then split up the work among the drafting-room force, giving the complicated jobs to the more experienced men. Each man designs his tool and makes the finished drawing directly on pencil tracing cloth.

MORTON SCHWAM

FIRE PREVENTION IN THE FACTORY

Many communities have a fire prevention week, when everybody is educated as to the importance of cutting down the nation's fire loss. This educational work lays most stress upon fires of domestic origin and in public places; but there is real need for education in the prevention of factory fires. It is in the interest of every man in any way connected with an industry to aid in preventing industrial fires. When there is a factory fire, both owners and wage earners are likely to suffer—the former through interruption in their business and the latter through being temporarily thrown out of work.

We need a fire prevention week in industry, a week when in every factory a check-up is made of the plant's fire prevention means and fire extinguishing equipment, and when the employes may be instructed about their own share in fire prevention in the shop.

JACOB BINDER

WHEN WORKERS KNOW THE COST OF THE MACHINES THEY OPERATE

In one shop, it has been found that proper care of the machines can best be insured by letting each workman know the cost of the machine that he uses. When the workman realizes the cost of the machine that he operates, he is likely to take better care of it than he otherwise would. Few shop men realize how expensive some of the machines they operate are.

This information can be given to the men in various ways—by the aid of a bulletin-board, through a shop paper, or through information given out by the foremen. The interest of the men in shop efficiency will also be stimulated when they realize that an expensive machine must get out a considerable amount of work to pay for itself, and that when it stands idle, it represents a dead loss to the company.

The more a man knows about his machine the more interest he will take in it, and when he realizes its cost, he will not abuse it or crowd it beyond its capacity, as is commonly done in many machine shops. The average workman also takes pride in the fact that he operates an expensive machine, and feels the responsibility of being entrusted with its care. Giving the men this information tends to create more confidence between the worker and the management.

M. BUSWELL

DESIGNATING TAPERS IN DEGREES

In connection with the present taper shank standardization work, the writer would suggest that it would be more convenient if tapers were designated in degrees rather than in taper per foot. While it is true that most lathe taper turning attachments and most grinding machine tables are graduated both in degrees and in taper per foot, it is also true that most lathes are not equipped with taper attachments, but nearly all have a compound rest graduated in degrees.

If all angular work was designated in degrees instead of in taper per foot, it would greatly facilitate matters. The universal milling machine, table base, the index head, vise base, and the vertical milling attachment are all graduated in degrees, and whenever there are graduations on the shaper, planer, boring mill, or gear-cutting machine, these graduations are also in degrees.

Furthermore, for international purposes, the degree provides a generally accepted system. The taper per foot is clearly understood only in countries using the English system of measurement, while degrees are universal all over the world. Hence, I believe it would be an improvement if all tapers were designated by the angle in degrees, rather than by the taper per foot.

ARMAND JASMIN

REDUCING OVERHEAD BY FOREMAN'S AID

To reduce the overhead of machine shop operation, the aid of the foreman is essential. He can do much to reduce the costs of repairs, machine upkeep, and supplies.

It is suggested that these overhead items be budgeted to each foreman and a sliding bonus scale be provided which would increase in a direct ratio to the reduction in cost of these items. The budget should be established on an annual basis, but the bonus ought to be paid quarterly. The foreman must be represented on the budgeting committee. It will mean some work to get such a plan started, but the results will be well worth the effort.

When the foremen have a real incentive to reduce overhead costs, repairs will be minimized by proper care of equipment; there will be less waste of compressed air, steam, electric current, and lubricating oil; drills, abrasives, tool steel, cotton waste, etc., will be more carefully handled; and even janitor costs may be reduced through gradual interest in cleanliness and orderliness in each department. The benefits of such a bonus system are certainly worth a trial in progressive shops.

DONALD R. WATSON

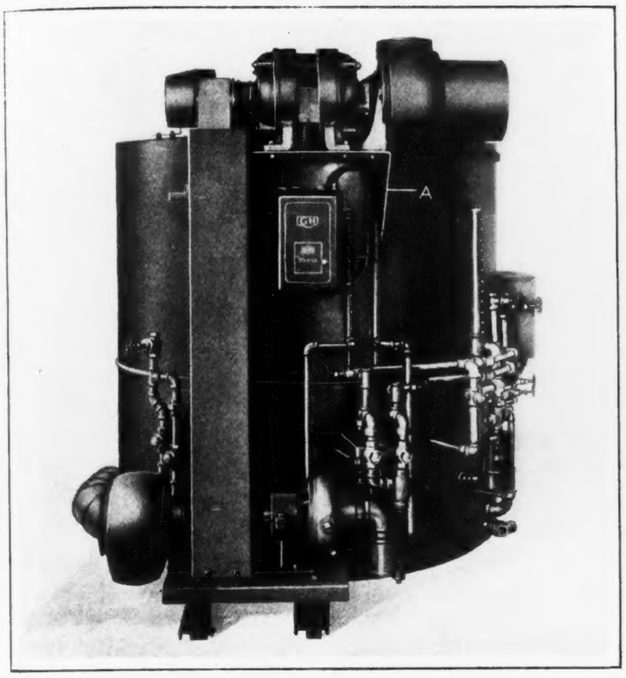


Fig. 1. Control Side of Washing Machine, Assembled by Arc Welding

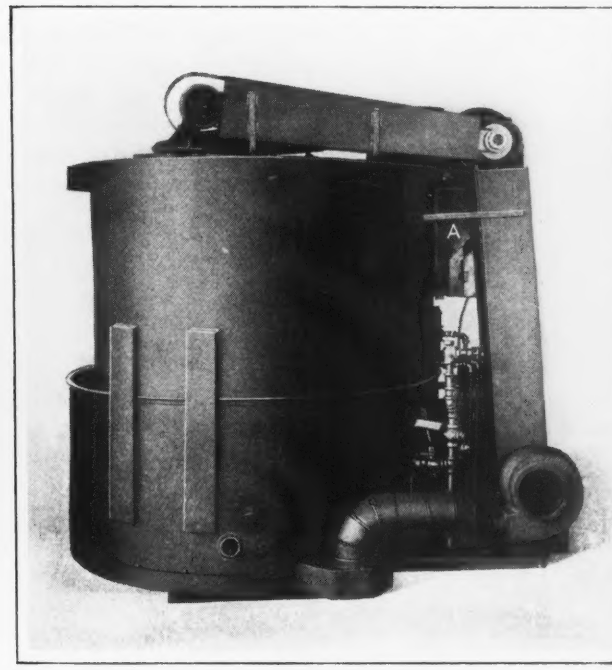


Fig. 2. Side View of Arc-welded Machine Illustrated in Fig. 1

How Arc Welding Cuts Assembling Costs

The Application of Electric Arc Welding in the Manufacture of Automatic Rotary Milk-can Washers has Materially Reduced Costs

By C. M. TAYLOR, Vice-president, Lincoln Electric Co., Cleveland, Ohio

THE automatic rotary milk-can washer shown in Figs. 1 and 2 offers a very good example of what can be done to reduce manufacturing costs by the application of electric arc welding. These washing machines are used for cleaning the large containers in which milk is shipped in bulk, and are made by the Kendall-Lamar Corporation, Potsdam, N. Y.

The design that preceded the one illustrated was one of conventional construction, and was more expensive to build than the highly competitive nature of the field would allow. As the principal labor cost in manufacturing the can washers is chargeable to assembly, it was obvious that any appreciable reduction in production costs must be made by adopting more economical assembling methods. The cost under the old method of assembling could not be lowered, and hence, electric arc-welding was adopted as a solution of the problem.

By the use of arc welding in the assembly of the various parts of the machine, the strength and the rigidity were increased to such a degree that many of the parts could be simplified in design. This resulted in lowering the assembly costs to considerably less than 50 per cent of the former charges for assembly. For performing the welding operations under the new system of assembling, welding equipment manufactured by the Lincoln Electric Co. was employed.

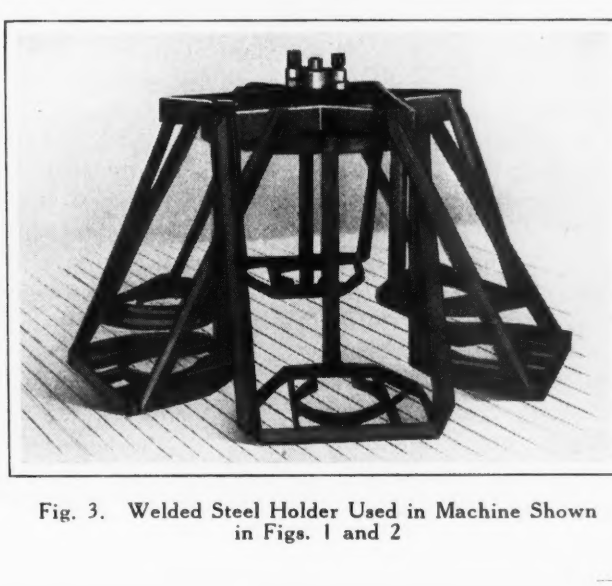


Fig. 3. Welded Steel Holder Used in Machine Shown in Figs. 1 and 2

The construction details of the arc-welded washing machine deserve particular notice. The motor bracket shown at *A*, Figs. 1 and 2, is made of a single piece of flat plate cut and bent to shape and welded to the shell. The guards around the driving belts are also arc-welded, and are held in place by straps welded to the shell. The base for the blower is built up from standard rolled shapes and plates, welded together. Even the motor starter is supported by welded brackets. The motor used to drive the milk-can washer also has an all-welded steel frame.

The substitution of welded steel for cast construction in the manufacture of a saddle plate or holder for supporting

six milk-cans and covers (shown in Fig. 3) is another instance in which marked savings were effected by employing welded construction. The saddle plates formerly made up of castings cost approximately $100, whereas the welded steel saddle shown in Fig. 3 costs only $30. The latter saddle is also considered more satisfactory from the viewpoint of service.

* * *

MACHINE TOOL PRICE BOOK STANDARD

The Associated Machine Tool Dealers, in cooperation with the National Machine Tool Builders' Association, have adopted a standard for machine tool price sheets and price books. It is expected that by June 1 the machine tool dealers will have been able to put this new standard into effect. Standard binders, paper, and accessories are available. In order to secure complete uniformity, the paper on which the new price sheets will be printed is supplied through the office of the Associated Machine Tool Dealers' Association by its secretary E. P. Essley, 551 W. Washington Blvd., Chicago, Ill.

The paper is available in white, green, buff, pink, and gray, trimmed to the right size and punched in the right position, so that when all the sheets are bound together, the book will be as uniform as if it was a regularly trimmed and bound book. Punches and trimming gages can also be obtained by those who wish to prepare special books for their field men, including standard and special circulars, photographs, etc. Complete directions for the use of the punches and trimming gages are supplied to those interested. A complete report has been issued by the Associated Machine Tool Dealers, covering the entire subject of these standardized price sheets and price books. Those interested should communicate with the Association.

* * *

ROLLER BEARINGS FOR HEAVY MOTORS

As an interesting example of the increasing use of roller bearings, it may be mentioned that each of the eight motors on the Baldwin-Westinghouse motor-generator locomotives used by the Great Northern Railway in its recently opened Cascade Mountains tunnel, is equipped with roller bearings supporting the 6-inch shaft on which is mounted the motor armature weighing 3730 pounds. These bearings were made by the Norma-Hoffmann Bearings Corporation and represent one of the largest roller-bearing installations for heavy duty that has been made in a machinery installation. The outer race of the bearing is 12 inches in diameter, and the speed in passenger service runs up to 1450 revolutions per minute.

Unusual Method of Machining Bearing Caps

It is the general custom of automobile manufacturers to cast the main bearing caps for the crankshaft bearings in the crankcase as separate pieces. This means, in the case of a six-cylinder engine, that seven separate pieces have to be handled and clamped for each machining operation. An article in June MACHINERY will describe a practice adopted by the Graham-Paige Motors Corporation which has effected a great saving in time and cost, both in the handling of the work and in jig, fixture, tool, and labor expense. This company runs the seven bearing caps through most of the machining operations as three castings, which are later sawed apart into the separate caps. The idea has been put into effect with unusually successful results in this plant, and may suggest similar savings in many other machine-building fields.

GROWING IMPORTANCE OF COMMERCIAL ARBITRATION

At a recent conference of Machinery and Equipment Associations held in Washington, D. C., W. W. Nichols, president of the Machinery Builders Society, in speaking on commercial arbitration, pointed out the value of arbitration in settling commercial differences, as compared with taking recourse to courts of law. Commercial arbitration is gaining ground rapidly in the United States, and many business contracts now contain a clause to the effect that any questions arising in connection with the fulfillment of the contract shall be settled through the recognized channels of commercial arbitration instead of by court action.

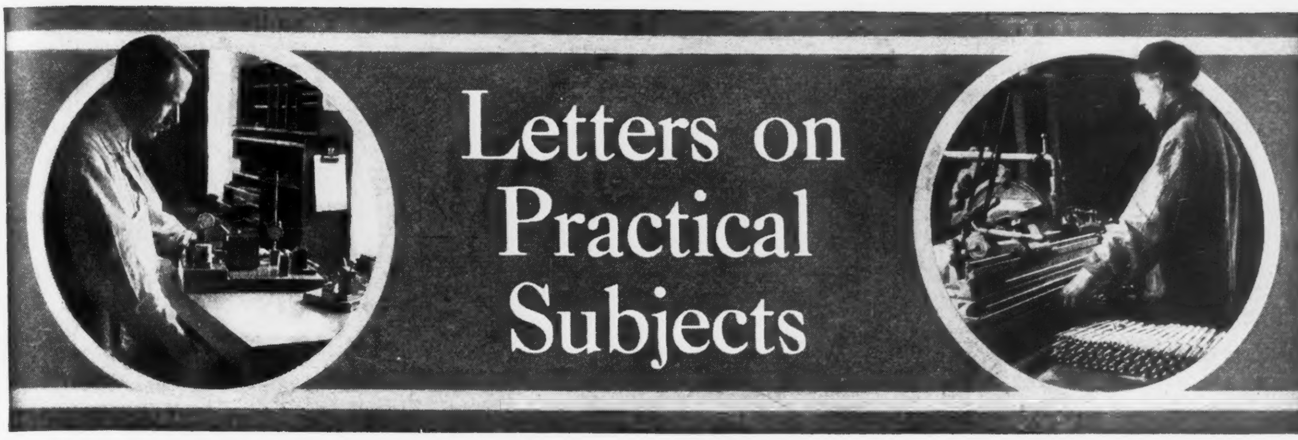
In this connection, it is of interest to note that commercial arbitration is not a new idea. Nearly 400 years ago the French, either taught by experience or with that amazing prescience that has often been attributed to that nation, instituted a practice that merits study by other nations. The French Court of Commerce, organized in 1563 exclusively for settling business disputes, has been eminently successful. The French procedure today is not greatly different from what it was when originally planned except that the number of commercial tribunals has increased as business expanded, until there are now 230 such tribunals in France.

These tribunals meet business requirements with an ease and expedition wholly unknown in American law practice. The "judges" in these courts are outstanding business men in their communities, and as the appointment to judge is considered a highly honorable distinction in the business community, the service is rendered without compensation. Disputes are judged on their intrinsic merits by business men in a business way, without recourse to legal technicalities. And what is more, these disputes are easily and definitely settled at a nominal expense, seldom exceeding $100. The decisions may be reviewed by appellate courts, but the records show that less than 25 per cent of the cases are appealed, and only about 5 per cent are reversed.

This is commercial arbitration pure and simple, and is the method that is now being urged upon American industries by commercial and industrial leaders as the only sensible method of settling differences and disputes between industrial and commercial concerns.

* * *

The proposed American recommended practice on the inspection of gears has recently been approved by the sub-committee handling this work. Copies may be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York.



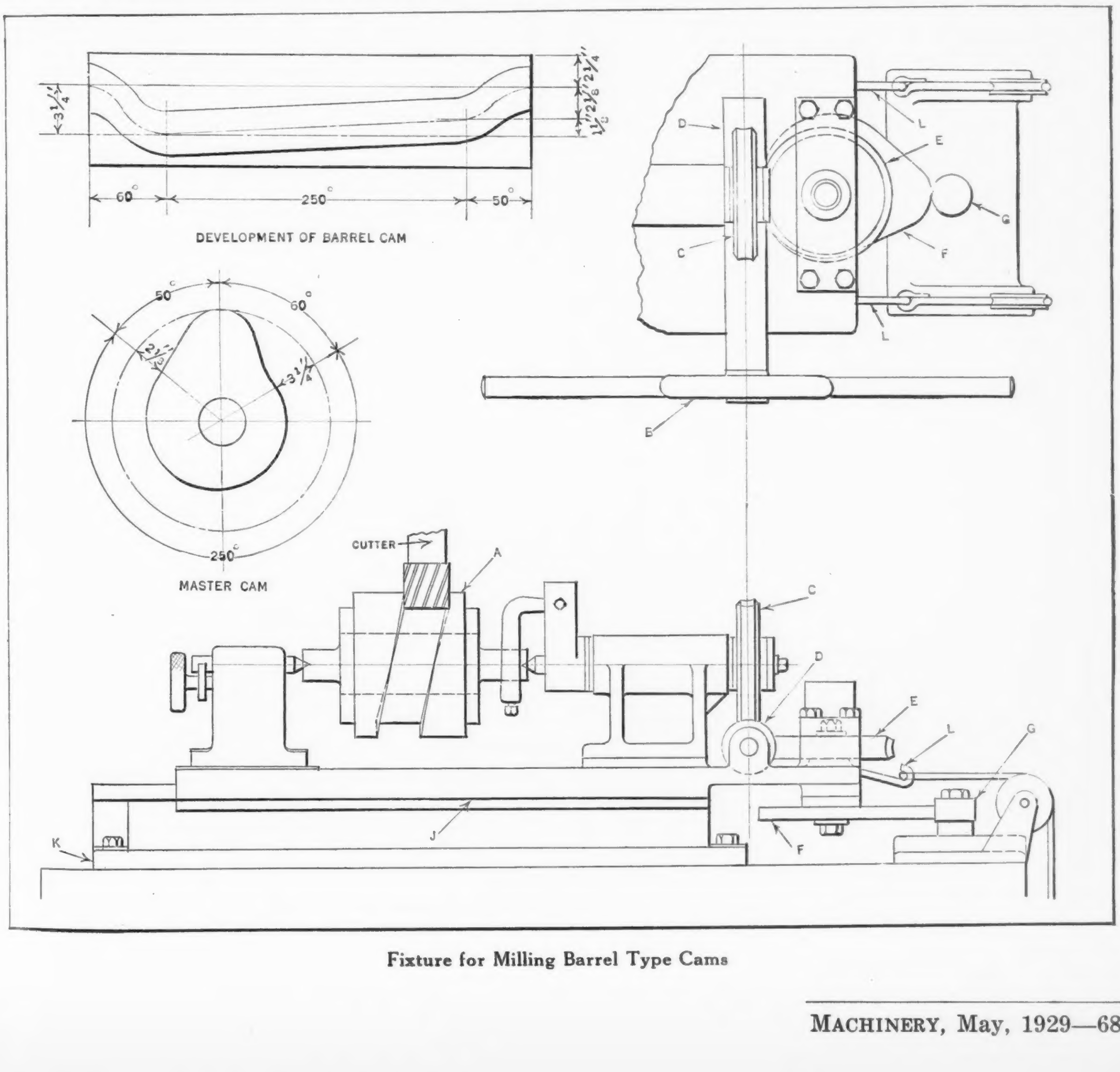
Letters on Practical Subjects

CAM MILLING FIXTURE

The fixture here illustrated was designed for milling barrel cams by the use of a flat plate cam as a master. The flat plate cam was used because a flat master is easier and less expensive to make than a barrel cam. These are important factors in shops making special machinery, as sometimes only one or two cams of one design are required. The cams that we have to make are generally about 10 inches in diameter and 8 inches long, and are made of machine steel. The fixture is bolted on the table of a vertical milling machine.

The barrel cam blank *A* is mounted on an arbor and held between centers. Worm *D*, which may be turned by handwheel *B*, drives the worm-wheel *C* which rotates the work, and also drives the worm-wheel *E* which rotates the flat master cam *F*. The headstock, tailstock, and driving mechanism are mounted on slide *J*, which moves horizontally on base *K*. The longitudinal movement of the slide is actuated by the master cam *F*, which is held against the roller *G* by counterweights. The counterweights are secured to the slide by flexible cables and hooks *L*. Worm-wheels *C* and *E* have the same number of teeth, so that the work revolves once for one revolution of the master cam.

The illustration also shows a development of a barrel cam with the corresponding master cam.



Fixture for Milling Barrel Type Cams

The barrel cam is divided into three parts, representing 60-, 250-, and 50-degree movements. The master cam is laid out in divisions of the same number of degrees.

During the first 60 degrees, the center line of the barrel cam drops 3 1/4 inches; therefore the master cam periphery drops 3 1/4 inches during the first 60 degrees of rotation. During the next 250 degrees, the barrel cam center line is raised 1 1/8 inches, and so at the corresponding point on the master cam, the periphery rises 1 1/8 inches, or to a point only 2 1/8 inches below the starting circle. During the remaining 50 degrees, the center line of the barrel cam returns to the starting center line, and so the periphery of the master cam rises to the starting circle. Only a few points were used in laying out the cam curve shown in the illustration, but in actual practice the cam curve is plotted through a great many points in order to give accurate results.

Rockford, Ill. WALTER E. GUNNERSON
EDWARD R. JOHNSON

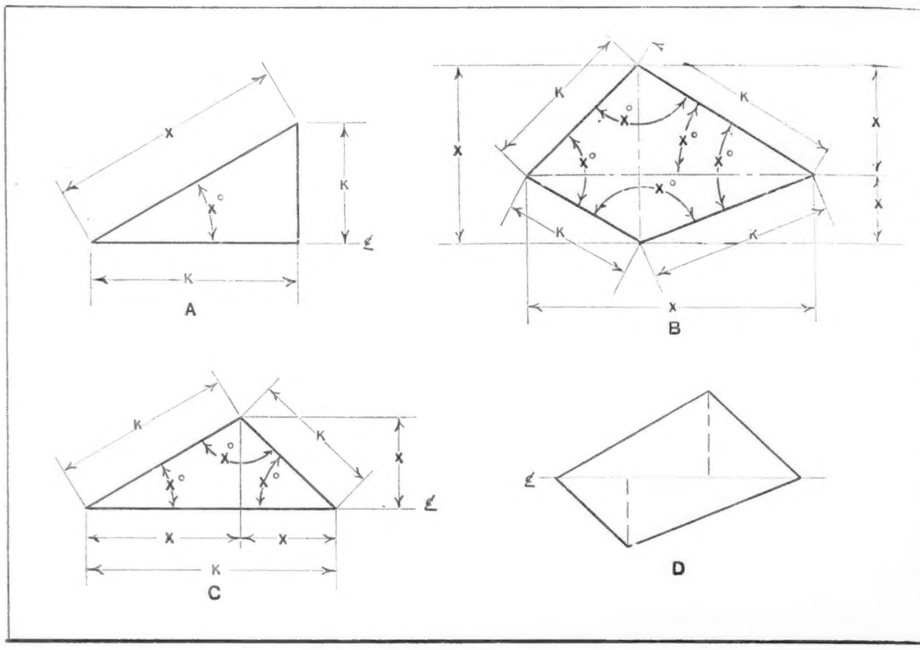


Fig. 2. Diagrams Indicating Kinds of Problems Solved with Button Block

SOLVING TRIANGLES WITH A MICROMETER

In Fig. 1 is shown a button block primarily intended for use in tool-rooms by workmen having a limited knowledge of trigonometry. The angles or sides of a triangle can be readily determined by using a micrometer or protractor to set the buttons *B* in accordance with known dimensions or angles, and then taking measurements to determine the angle or side required.

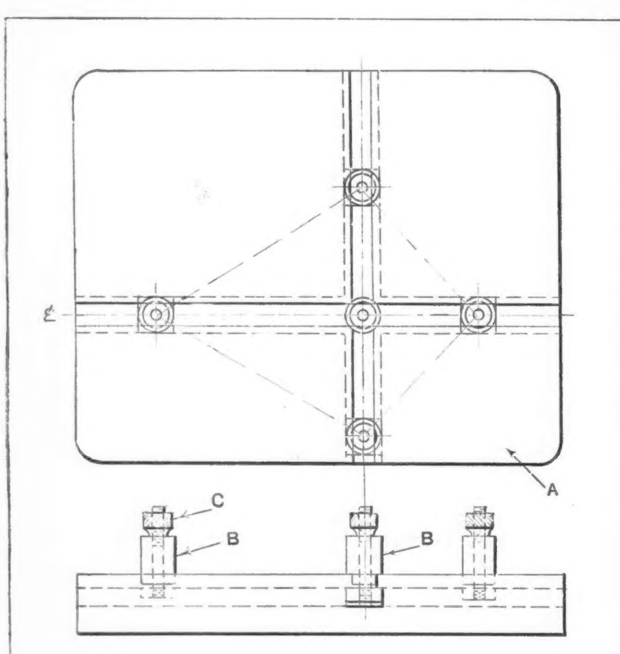


Fig. 1. Button Block Used in Solving Triangles

The solution of triangles by this method requires no calculating and does not involve the use of sines, cosines, or tangents. Obviously, the button block provides a convenient means for checking the accuracy of results obtained by trigonometrical calculations. It also provides an excellent means for teaching apprentices how to handle micrometers and protractors.

The button block *A* can be made of machine steel. The T-slots should be accurately milled at right angles to each other and parallel with the edges of the block. The hardened and ground tool-steel buttons *B* are a sliding fit in the T-slots. The buttons are locked in any desired position by tightening the knurled thumb-nuts *C* on studs threaded into square nuts in the T-slots. All the buttons are accurately ground to a diameter of 0.300 inch, and this amount is added to the known dimensions when setting the buttons. The same amount is, of course, subtracted from the measurements which give the final results.

The third side of a right-angle triangle having any two sides given can be found by setting the buttons in accordance with the given dimensions by means of a micrometer, and then measuring over the buttons to obtain the length of the third side. A protractor graduated to read within 5 minutes by the use of a vernier scale can be used to determine the angles after the buttons are set.

In measuring angles, the head of the protractor is held against one edge of the block and moved along until its blade is tangent to the two buttons that determine the required angle. Thus, it is possible to find the two sides of a right-angle triangle when one side and one angle are known. The unknown sides and angles of oblique triangles or four-sided irregular polygons can be found by similar methods. Sometimes it is necessary or more convenient to use two micrometers in setting the buttons. A height gage and surface plate can also be used to advantage in solving certain problems.

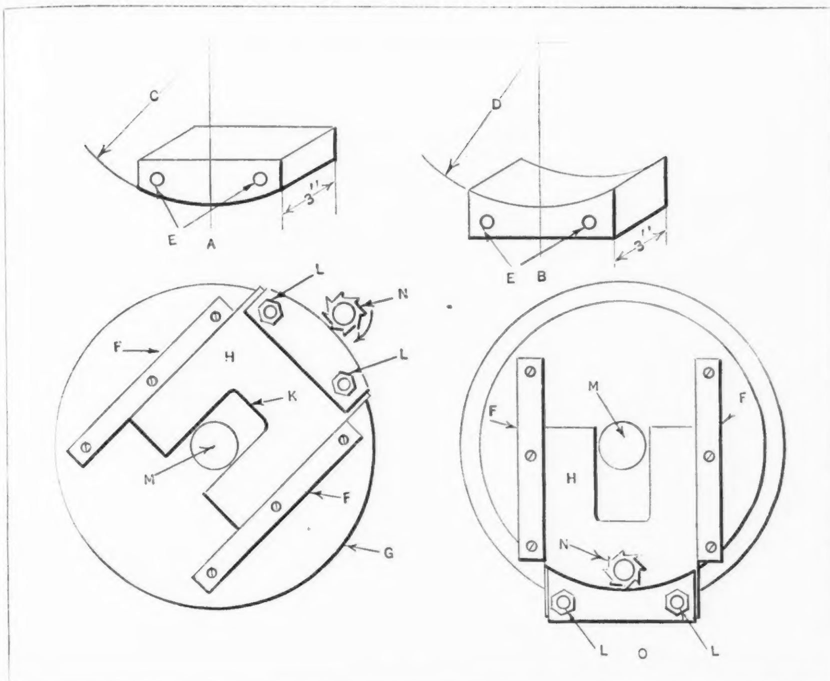


Fig. 1. Large-radius Forming Punches and Dies and Set-up Used in Milling Curved Surfaces

The diagrams *A*, *B*, *C*, and *D*, Fig. 2, indicate the types of problems that can be readily solved with the button block. In these diagrams, the letter *K* is used to denote the known dimensions and *X* indicates the dimension or angle to be found. If, in any diagram, the dimensions indicated by *K* are known, the unknown dimensions and angles *X* can be obtained from the button block.

Villa Park, Ill. C. W. Hinman

MILLING AND GRINDING LARGE-RADIUS PUNCHES AND DIES

When a number of dies of similar form are to be made, the toolmaker seldom attempts to employ production methods. This does not, of course, apply to the planing or milling of bolsters, punch-holders, and other work that can be set up in multiple units on the machine. The cost of making a set of punches and dies can be materially lowered in many cases by thorough planning and a little preliminary work.

An example of this kind of work is the forming punch and die shown at *A* and *B*, Fig. 1. These pieces are made of steel and in various sizes having radii *C* and *D* ranging from 9.750 to 11.125 inches. In all, six each, of eight different sizes were to be made, giving a total of forty-eight complete dies to be used in forming special brake-shoe material. The number required gave the work the semblance of a smaller production job. For this reason, considerable thought was given to the machining and grinding methods used. In the first place, there was no grinding machine in the shop which had a swing large enough to accommodate the work, thus making it necessary to provide special equipment.

As it was important that both the punches and dies be accurately located, it was decided to provide a jig for use in drilling and reaming locating holes *E* in all the pieces as soon as they had been planed to shape and trued up. These holes were then used for locating the work for all succeeding machining and grinding operations. A vertical milling machine having a circular table *G* was used in machining the curved surfaces. Two parallels *F* were secured to the table as indicated, and the plate *H* made a sliding fit between the parallels.

At the outer end of plate *H* were placed the threaded dowels *L*. These dowels and suitable clamps—not shown—were used to hold the work in place and also to clamp the plate in its proper position with respect to the center of the machine spindle. The plug *M* was accurately located in the center of the circular table to facilitate taking measurements when checking or locating the work. A slot *K* was cut in the sliding plate *H* to provide clearance for the plug *M*. With this equipment, it was an easy matter to generate the curved surface to the required radius by revolving the circular table through an arc of sufficient magnitude to feed the work past the milling cutter *N*. Allowance for final grinding was made when milling the punch or die.

The concave surface dies were set up in much the same manner as the convex surface punches. The same circular plate, with one of the dies clamped in place, is shown in the view at *O*, Fig. 1. The work in this case was held in place by means of C-clamps and nuts *L*. The use of dowel-pin holes

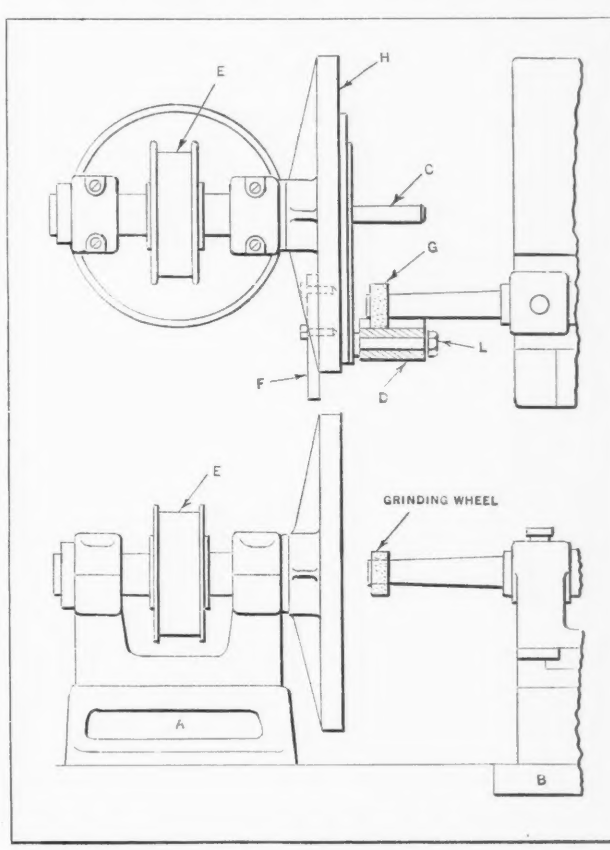


Fig. 2. Set-up for Grinding Curved Surfaces of Pieces Shown at A and B, Fig. 1

for locating purposes insured accurate location of the work and enabled it to be quickly clamped in place.

While the machine work on the dies was in progress, an internal grinding machine was fitted with filler blocks, such as shown at *A* and *B*, Fig. 2, in order to give the required swing. A large faceplate *H* was obtained from the tool-crib. This faceplate was fitted with an adapter which enabled it to be mounted on the spindle of the grinding machine. A measuring plug *C* was placed in the center of the faceplate for convenience in taking measurements. The plate and parallels previously used for milling were set up on the grinder, and the internal grinding wheel *G* was used for grinding the convex surface of the punch pieces. The cross-section view at *D* shows one of the dies clamped in place ready for grinding. One of the two threaded studs used to clamp the work in place is shown at *L*.

In order to avoid "cutting air" for three-fourths the revolution of the work-spindle, the driving belt was removed from the pulley *E* and a piece of flat stock *F* bolted to the back of the faceplate and used as a lever to rock or oscillate the work while the grinding wheel traveled back and forth across the curved surface. With the simple equipment described, it was possible to machine the punches and the dies rapidly and at the same time maintain a high degree of accuracy. A. A. D.

KEEPING DRAWINGS CLEAN

With present-day methods of making pencil tracings, the draftsman is constantly confronted by the problem of keeping his tracings clean, whereas with the old method of making ink tracings, when the draftsman was through with a drawing, he simply went over the entire tracing with an art gum cleaner without fear of erasing anything.

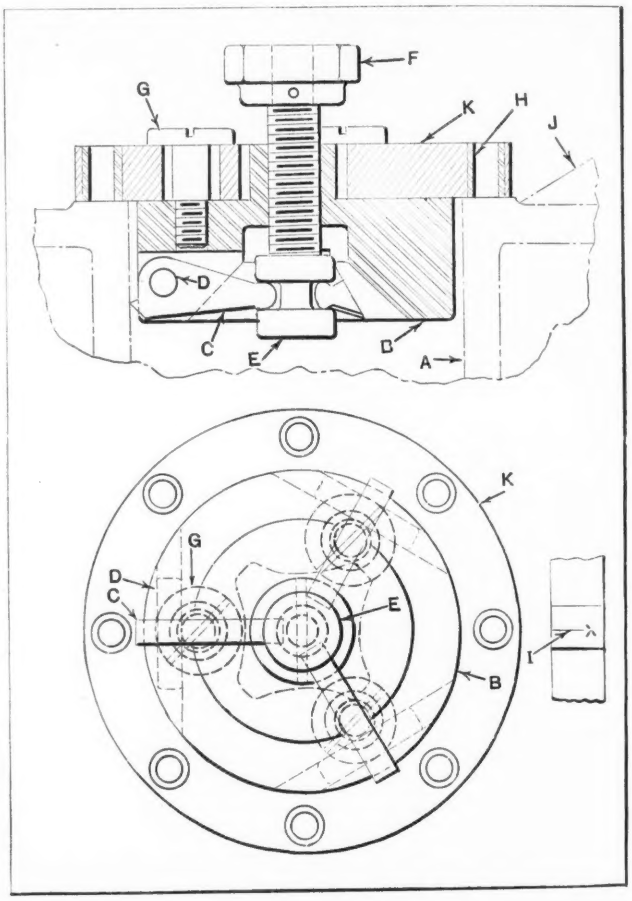
Drawings become untidy, due mostly to moving the T-square or straightedge over the tracing. This is especially true of pencil tracings. This danger of soiling the tracing may be overcome by placing a string over the tracing at right angles, to the T-square and fastening the two ends together under the drawing-board with a rubber band and a hook made from a paper-clip. The rubber bands keep the string tight and allow it to be shifted to avoid the triangles. Two or three such strings should be placed at various intervals, depending on the size of the tracing. Now when the straightedge is moved over the drawing, it will not bear on the drawing, but on the strings. Another method is to fold some drawing paper into strips and place these at right angles to the T-square, fastening the ends to the top and bottom edges of the board with thumb-tacks.

Philadelphia, Pa. PHIL SCHVOM

FLANGE DRILL JIG WITH FLOATING INTERNAL CLAMP

The jig shown in the accompanying illustration was designed by the writer for rather an unusual flange drilling job. The flange to be drilled was for the clean-out outlet of a condensing pump. As the flange had no projecting rim or part to which a jig of the usual type could be clamped, it was necessary to employ the internal surface *A* for clamping. This was done by using three evenly spaced clamping fingers *C* mounted on a floating member *B*, which permitted the bushing plate *K* to be lined up with the external boss, regardless of the position of the cored hole.

The jig plate *K* is turned to the same diameter as the flange, and carries the eight drill bushings *H*. The clamping unit *B* slides against the bottom of plate *K*, and is confined by three shoulder screws *G*, which also take the tension resulting from the clamping action. The pointed clamping fingers *C* swing on pins *D* in member *B*. One end of each



Jig for Drilling Flange of Condensing Pump

of the fingers engages the groove cut in the bottom of the binding screw *E*, which is operated by means of the hand-knob *F*.

In applying the drill jig, the screw *E* is turned back until the points on fingers *C* clear the wall *A* of the casting. The jig is then dropped on the flange, and with the center line marked *X* coinciding with the center of rib *J* on the casting, the outside of plate *K* is lined up with the flange. Screw *E* is then turned in the opposite direction until the three finger points grip the casting walls. The three large clearance holes in plate *K* for the member *B* and screws *G* allow the finger points to automatically adjust themselves for an equalized gripping pressure without disturbing the location of jig plate *K*, even though the cored hole be slightly offset. This type of jig has been used successfully on other work of a similar nature.

Fairfield, Conn. J. E. FENNO

FINDING CENTER OF PRESSURE OF BLANKING DIE

To prevent excessive strain and wear on aligning pins and ram guides, the center of pressure of a blanking die should be in line with the center of the ram. This point is easily, quickly, and accurately located by the method given here, which, although theoretically correct, may be used without stopping to review the underlying principles.

The procedure is as follows:

1. Draw an outline of the actual cutting edges, as indicated in the accompanying illustration.

2. Draw axes X–X and Y–Y at right angles in a convenient position. If the figure is symmetrical about a line, let this line be one of the axes. The center of pressure will in this case be somewhere on the latter axis.

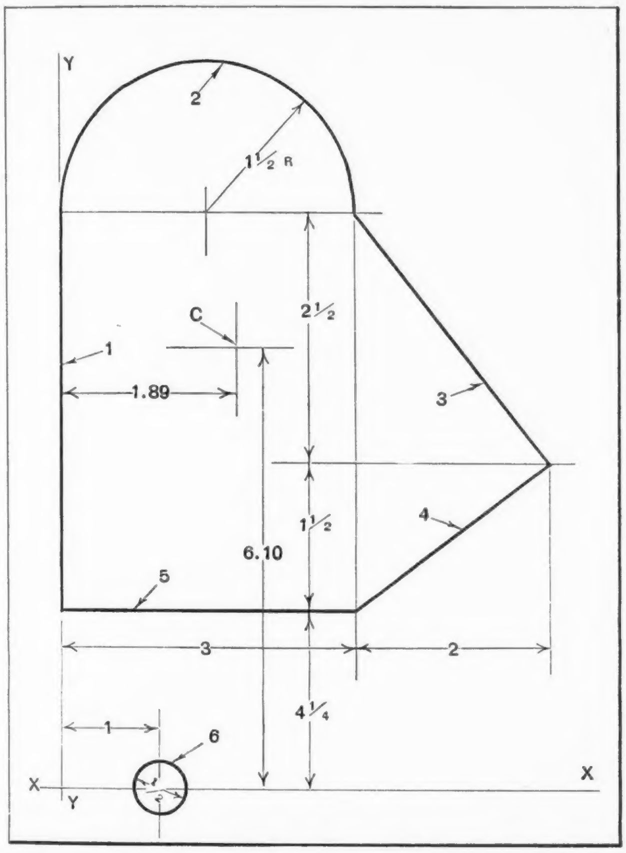


Diagram for Finding Center of Pressure of Blanking Die

3. Divide the cutting edges into line elements, straight lines, arcs, etc., numbering each, 1, 2, 3, etc.

4. Find the lengths l_1, l_2, l_3, etc., of these elements.

5. Find the center of gravity of these elements. See MACHINERY'S HANDBOOK, page 290, sixth edition. Do not confuse the center of gravity of the lines with the center of gravity of the area enclosed by the lines.

6. Find the distance x_1 of the center of gravity of the first element from the axis Y–Y, x_2 of the second, etc.

7. Find the distance y_1 of the center of gravity of the first element from the axis X–X, y_2 of the second, etc.

8. Calculate the distance X of the center of pressure C from the axis Y–Y by the formula:

$$X = \frac{l_1x_1 + l_2x_2 + l_3x_3 + l_4x_4 + l_5x_5 + l_6x_6}{l_1 + l_2 + l_3 + l_4 + l_5 + l_6}$$

9. Calculate the distance Y of the center of pressure from the axis X–X by the formula:

$$Y = \frac{l_1y_1 + l_2y_2 + l_3y_3 + l_4y_4 + l_5y_5 + l_6y_6}{l_1 + l_2 + l_3 + l_4 + l_5 + l_6}$$

In the accompanying illustration, the elements are shown, numbered 1, 2, 3, etc. The length of l is obtained directly from the dimensions, and is seen to have the value 4. The center of gravity is evidently at the geometrical center of the line. Therefore $x_1 = 0$ and $y_1 = 4\ 1/4 + 4/2$ •

In the case of x_2 we refer to MACHINERY'S HANDBOOK, page 290, for the rule for finding the position of the center of gravity, which is found to be 1.5. The value for y_2 is also found by reference to the HANDBOOK. To find the requirements for line 3, it is necessary to solve the right triangle of which it is the hypotenuse.

The requirements for the other elements are found in a similar manner, all values being entered in a table, as shown below. The products may be obtained with sufficient accuracy with a slide-rule.

Element	l	x	y	lx	ly
1	4.00	0.00	6.25	0.00	25.00
2	4.71	1.50	9.20	7.05	43.20
3	3.20	4.00	7.00	12.80	22.40
4	2.50	4.00	5.00	10.00	12.50
5	3.00	1.50	4.25	4.50	12.75
6	1.57	1.00	0.00	1.57	00.00
	18.98			35.92	115.85

These values are then substituted in the preceding formulas from which,

$$X = \frac{35.92}{18.98} = 1.89 \text{ inches; } Y = \frac{115.85}{18.98} = 6.10$$
inches

The center of pressure C is therefore located as indicated in the illustration.

Riverside, Ill. J. S. BEGGS

DETERMINING PULLEY SIZES AND SHAFT SPEEDS

The accompanying chart provides a convenient means for determining the size of pulley required to give a certain shaft speed, when the speed of the two shafts and the diameter of one pulley are known factors. The speed of one shaft can also be obtained with equal facility when the pulley diameters and the speed of the other shaft are known.

The following example will serve to illustrate the method of using the chart: Suppose we have a motor running at 1200 revolutions per minute, which is equipped with a 4-inch driving pulley, and it is necessary to employ this equipment to drive a shaft at a speed of 400 revolutions per minute. What size pulley should be used on the driven shaft?

Referring to the chart, we locate the vertical line representing a shaft speed of 1200 revolutions per minute and follow this upward to the point where it intersects the horizontal line representing a pulley diameter of 4 inches. From this point fol-

low the diagonal line to the point where it intersects the vertical line representing a shaft speed of 400 revolutions per minute. From the latter point follow the horizontal line to the left side of the chart, where we find the figure 12, which is the diameter, in inches, of the pulley required. The shaft speeds given at the top of the chart run from 12.5 to 200, and at the bottom of the chart the range is from 125 to 2000 revolutions per minute. Only one speed range can be used in solving a problem.

Cedar Rapids, Ia. ALBERT L. VOGGENTHALER

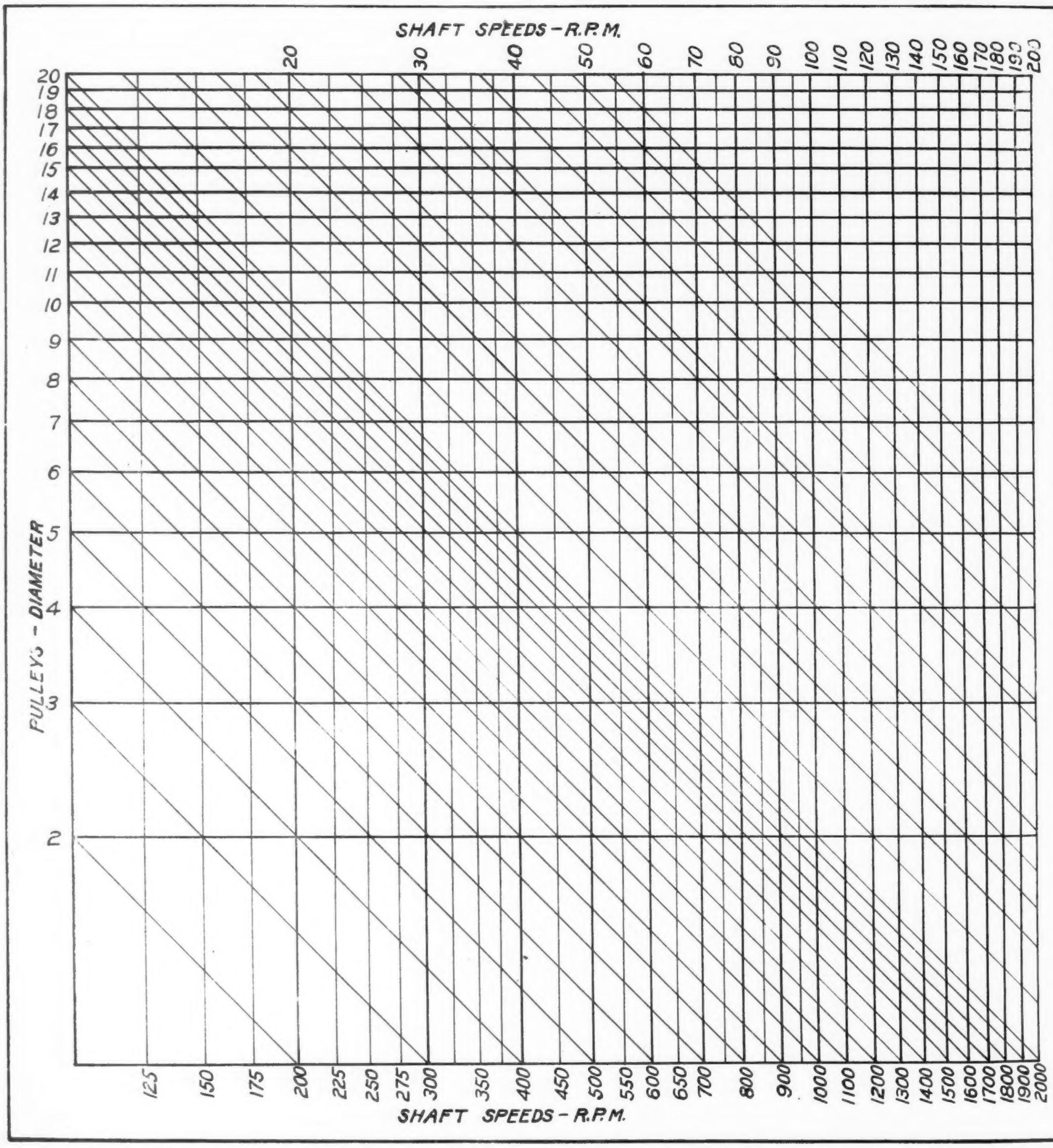


Chart for Determining Pulley Sizes and Shaft Speeds

PUNCHING SLOTS IN HIGH-SPEED STEEL

Contrary to expectations, punches made of high-speed steel proved successful in piercing slots 3/32 by 3/4 inch in large quantities of hard drawn flat steel wire, 1/32 inch thick.

Ontario, Calif. H. R. HAGEMAN

PREVENTING SPLIT PULLEYS FROM SLIPPING

The writer recently became acquainted with a method of preventing split pulleys from slipping on their shafts as a result of overloading. A very thin paper is treated on one side with glue, such as is used for renewing polishing wheels. Before this glue dries on the paper, it is dusted with fine emery. After the glue is dry, the paper is wrapped around the shaft, care being taken to see that it does not overlap where the ends join. The pulley is then carefully assembled and tightened on the shaft. The emery improves the gripping qualities between the pulley and the shaft, while the thin paper serves only as an agent for the even distribution of the emery. It has been found that, in all cases where this treatment has been applied, trouble from slipping of the pulleys has been entirely eliminated.

Fairfield, Conn. JOSEPH E. FENNO

What I Would Do If I Designed a Lathe

A Few Suggestions for Improvements in the Design of Engine Lathes Based on Thirty Years' Experience in Their Use in Many Different Shops

By HERBERT A. FREEMAN

THE suggestions for modifications in lathe design which have appeared in MACHINERY from time to time have been read with interest by the writer, who offers additional suggestions in the present article, which he believes should be given careful consideration in designing lathes. It is understood that some of these "ideals" may not be practicable in commercial lathe design, but they are offered in a cooperative spirit.

A reduction in the number of spindle diameters and threads to about six standard sizes should be made. Standardization of the handle positions and movements on quick-change gear transmissions for speeds and feeds is also desirable. Once upon a time there were a great many different kinds of automobile gear shifts, and, to the writer's mind, the standardization of gear shifts for machine tools would be as favorably received by machine tool operators as the standardization of automobile gear shifts has been by automobile drivers.

The writer believes that the beds of most lathes are made too light and that a great deal may be said in favor of plenty of weight at this point. A very good production machine has been made out of a lathe having a light-weight cast-iron bed, by filling it with concrete. The horizontal bearing surface should be located on the back shear. There should be as little horizontal chip-catching surface on the shears as possible. This may be attained by allowing the vees to join steeply inclined or vertical surfaces. A heavy lug or socket cast on the bed would permit a customer to easily equip the lathe with a davit-like bar and hoist, so that the handling of a large chuck or heavy work could be done by one man instead of two.

More Adjusting Screws and Improved Graduations Suggested

A better method for setting over the compound rest than the present soft-hammer one is provided by a simple device developed by the writer. It consists essentially of a clamp which encircles the tailstock spindle and carries arms with set-screws for adjusting or offsetting the tailstock.

Larger or more easily read markings on the circular scale of the compound rest, together with a vernier, are generally desirable. There is no good reason why improved graduations should not permit the accurate duplication of tapers. A more distinct or outstanding mark for the 60-degree graduation on the circular scale of the compound rest would be a great convenience in many thread-cutting operations. Another convenience in thread-cutting would be a longitudinal line scribed on the tailstock spindle at center height. A 60-degree notch cut in the tailstock, in combination with this scribed line, would do away with all guesswork in setting a threading tool.

Tailstocks might be provided with a method of obtaining vertical adjustment. This would eliminate the necessity for using packing blocks to raise the tailstock the required amount to compensate for the metal removed from the tailstock ways when they are refitted or scraped.

Provision for quickly setting the tailstock to the correct center position after it has been set over for taper turning should also be made. This may be done by employing a taper key or pin, thus doing away with the present method of using an aligning bar and an indicator. The tailstock body, if designed to limit the outward extension of the spindle, would prevent the excessive strain, wear, and sag that often result from using the spindle too frequently in an over-extended position. A graduated tailstock spindle is a great help in drilling holes to specified depths.

Headstock Might Be Adapted for Indexing

The complete enclosure of all headstock gears is desirable, but if the main headstock spindle gear is made easily accessible through a door in the cover, and if the gear itself has for its number of teeth the lowest common multiple of as many numbers as possible, a time-saving means of quick and reasonably accurate indexing would be available. This feature would be particularly useful in the jobbing shop. If the headstock centers are threaded and provided with an extracting nut similar to that used on small drill press spindles for removing a drill chuck, the present crow-bar method of removing centers would be avoided, together with its detrimental effect on the headstock bearings.

A support for the work in the back end of the draw-in rod of collet chucks would help to hold the stock in a central position, prevent slippage of the work under heavy cuts, and reduce the number of broken collets. A spindle brake which would save time when gaging, and also lessen the temptation to gage rapidly revolving work, could be provided on most patternmaker's lathes.

Ball-bearing Lathe Carriages

The application of ball bearings to lathe carriages is a field in which experiments might well be conducted. Friction and wear on the vees might be practically eliminated by their use. The writer made an experimental carriage which moved on ball bearings mounted on stationary axles. It was found that by grinding the tools with suitable clearance and rake angles, they would feed themselves into the work automatically when the carriage was entirely disconnected from the feed-rod.

In the smaller size lathes, carriages could be provided with conveniently located tapped holes for work-holding bolts. Lines showing when the cross-slide is so positioned that the axis of the compound

rest is in the same vertical plane as the lathe centers are extremely useful in performing spherical turning operations. A tool-holder something on the lines of a boring-bar holder, but with a taper for holding drill shanks, will permit drills to be held in the carriage and allow the power feed to be employed for performing drilling operations.

It is believed that there is a demand for a flat table with T-slots. A table of this kind could be traversed by the feed-rod or by the carriage. In the latter case, the carriage would operate at the rear of the tailstock and be connected with the table by a link of some kind. The "threading clock," as it is generally called by lathe operators, should be so positioned on the carriage that it will not be obscured when the compound rest is set over the 60-degree position.

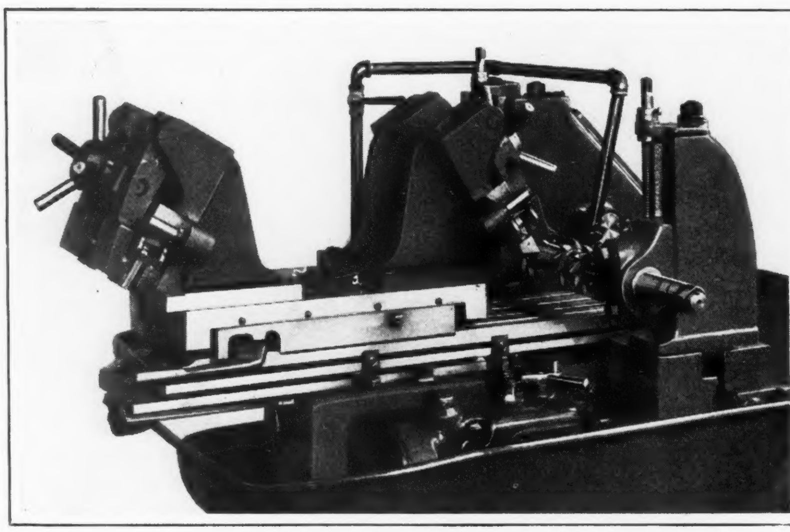


Fig. 1. Automatic Milling Machine Equipped for Producing a V-shaped Surface at One End of Brake-shoe Adjusters

Increasing Safety and Convenience of Operation

As a safety precaution, provision should be made for stopping a lathe from any position along the bed. All controlling wheels or handles, if rubber-covered, would add to the comfort of the operator and lessen the danger of electric shock from a grounded circuit. All tailstock spindle controls should be effected by a handwheel and not by a ball-crank. It is preferable that the diameter of the handwheel be about half the nominal swing of the lathe. The hub should be offset so that a bar can be used to give extra leverage when drilling.

Chip boxes mounted on wheels or casters so that they could be easily dumped might be so designed that they could be run under the bed of the lathe. Lathe beds could be easily provided with grooves, which would serve as gutters for the coolant and thus provide cleaner operating conditions.

The final suggestion has to do with the sales policy rather than the design of lathes, and concerns the steadyrest and follow-rest. Why not eliminate these altogether as standard equipment? These devices are generally laid away in the tool-crib and seldom used.

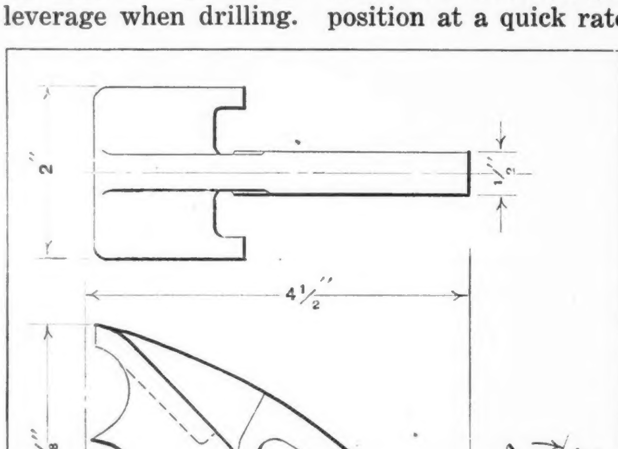


Fig. 2. Outline of the Brake-shoe Adjuster Milled in the Machine Shown in Fig. 1

MILLING BRAKE-SHOE ADJUSTERS

Considerable ingenuity was required in designing fixtures for use in milling malleable-iron brake-shoe adjusters of the type illustrated in Fig. 2. In this milling operation, which is performed in two steps, the part is milled to a V-shape at the lower end, as indicated by the heavy lines. The fixtures finally designed are illustrated in Figs. 1 and 3, the milling operation being performed on a Cincinnati 18-inch plain automatic milling machine equipped with a 12- by 24-inch index-base.

Two fixtures are provided, one at each end of the index-base, and four brake-shoe adjusters are held in each. Two of these pieces are clamped to be milled on one side and the other two to be milled on the opposite side. Each piece is located by means of the 1-inch half bore at the upper end and the 3/8-inch slot near the middle, both the half bore and the slot being fitted over studs. A spring plunger acts below one wing to hold the work against the 1-inch stud. One side of the part rests on a 60-degree inclined hardened block. All four pieces are gripped securely by means of clamps operated by the pilot wheel.

After the base has been indexed at the end of an operation so as to bring new work in line with the cutters, the table is automatically advanced rapidly to the cutting point, then fed at a milling rate, after which it is automatically returned to the starting position at a quick rate. Two pieces of work are finished at each cycle, and after either fixture is withdrawn and the table indexed, the two pieces completely machined are removed and replaced by the two pieces finished on one side, while the latter pieces are replaced by new castings.

Although the work pieces and the fixtures are heavy, the index-base can be swiveled easily, due to the fact that the top plate rides on a roller thrust bearing while being indexed. This thrust bearing is supported by a number of springs which balance the weight of the top plate, fixture, and work. Operation of

the indexing lever serves to compress the springs and clamp the index-base top plate securely to the bottom plate.

In this milling operation, stock is milled from the solid by four slotting cutters, 4 inches in diameter. These cutters have one beveled edge and are run at a speed of 80 revolutions per minute. The table feed is 6.4 inches per minute, which makes the time per piece 0.21 minute, giving an average production of 250 pieces per hour, with an allowance of about 10 per cent for shop conditions.

The control of the table by means of dogs on one side permits entirely automatic operation of the machine. The operator simply loads and unloads the work pieces and indexes the base while in one position at a point farthest from the cutters. With the exception of the work-holding fixtures, the machine is entirely standard.

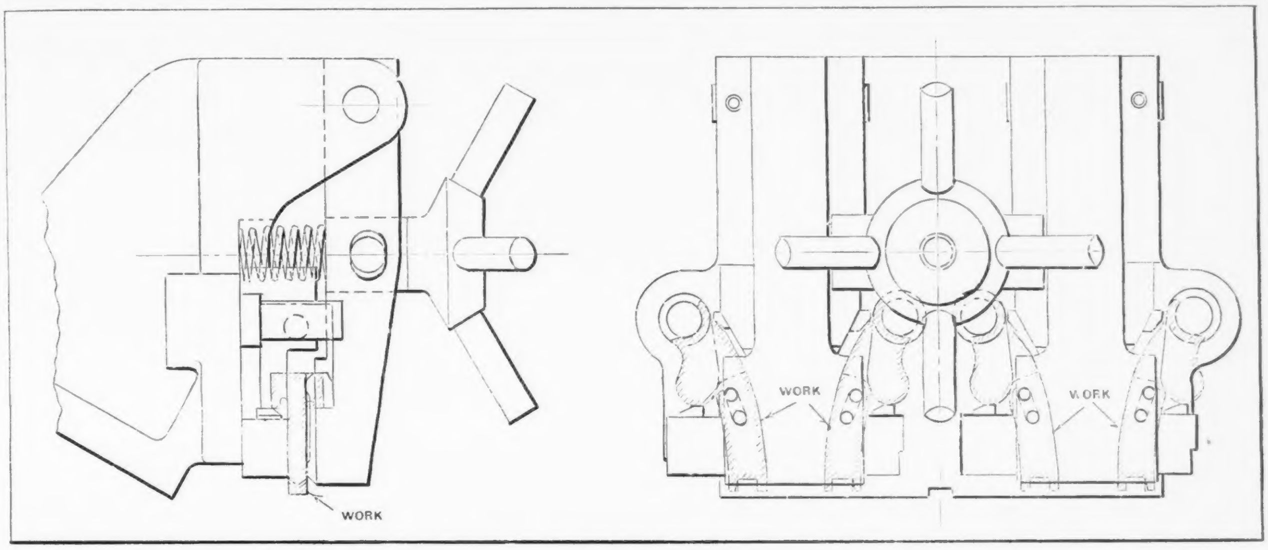


Fig. 3. Construction of the Fixtures Developed for Holding Four Brake-shoe Adjusters at One Time while Milling

* * *

NATIONAL METAL TRADES CONVENTION

The thirty-first annual convention of the National Metal Trades Association was held at the Drake Hotel, Chicago, Ill., April 24 and 25. A two-day conference of branch secretaries preceded the actual convention, which was opened by an address of welcome by W. F. Winans, president of the Chicago Association of Commerce. This was followed by an address by the president of the National Metal Trades Association, Harold C. Smith, president of the Illinois Tool Works, Chicago, Ill. The keynote of the convention program was "Problems and Progress in Industry," and both the president's address and the papers presented at the convention may be said to be grouped under this heading.

"Progress in Transportation" was the topic discussed by Elisha Lee, vice-president of the Pennsylvania Railroad, who touched, among other things, upon the entry of the railroads into the field of aerial transportation. G. W. Vaughan, vice-president of the Wright Aeronautical Corporation, spoke on "Progress in the Air," dealing with some of the problems of precision manufacture in large-scale production of aerial equipment.

The topic covered by Dr. Harry Myers of the Frigidaire Corporation was "Progress in Employe Relationships," and the manner in which the fundamental principles outlined by Dr. Myers are applied was also described by Sterling Morton, president of the Teletype Corporation.

Industrial education, a subject of first importance in the industries today, was dealt with in a report presented by Louis Ruthenburg, president of the Copeland Products, Inc., and foremanship conferences were dealt with by George Seyler, works manager of The Lunkenheimer Co. Mr. Seyler's demonstration of the application of the efforts of the National Metal Trades Association in training and education and in the improvement of workmanship and leadership followed the Industrial Education Committee's report. This demonstration enabled those present to study at first hand what appears to be the best means yet found to aid the foreman in becoming increasingly competent to fill his place in modern industry.

Otto P. Geier, vice-president of the Cincinnati Milling Machine Co., spoke on "Progress in Management," and Walter Gordon Merritt, counsel for the League for Industrial Rights, discussed the steps being taken by the courts to contribute more constructively to the efforts to obtain industrial co-operation between employers and employes.

Other interesting addresses at the convention were presented by Wheeler McMillan, editor of *Farm and Fireside*, who spoke on "Problems and Progress in Agriculture"; by Dr. T. N. Carver, professor of the Department of Economics, Harvard University, whose topic was "How Long Will Prosperity Last?"; by Francis H. Sisson, vice-president, Guaranty Trust Co., New York City, who spoke on "Problems of Prosperity"; and by Whiting Williams, Counsellor on Industrial Relations, who contrasted conditions in American industries with those in Russia and Italy, his topic being "Men and Managers under Mussolini, Marx, and Hoover."

* * *

The United States Bureau of Public Roads estimates that motor vehicles in the United States last year traveled a total of 137,000,000,000 miles. This is based on a consumption of 10,596,000,000 gallons of gasoline, allowing 12.9 miles to a gallon.

Widia, a Tungsten Carbide Cutting Metal*

The Original Tungsten Carbide Cutting Metal First Placed on the Market in Germany was Called Widia—It is Now Largely Used Here

By RODGER D. PROSSER, Thomas Prosser & Son, New York City

THERE has been an increasing interest throughout the metal-working industries in tungsten-carbide-cobalt alloy cutting tools ever since these tools were first placed on the market by the Krupp Works of Essen, Germany, in 1926. The new material was named Widia, the name being derived from the German words "wie Diamant" (like diamond). Later, the Krupp Works made arrangements with several concerns in the United States, granting licenses for the manufacture of similar tungsten-carbide-cobalt alloys, to be sold under different trade names. The companies licensed to make this material in this country will doubtless use quite different processes of manufacture from those employed by the Krupp Works, so that the various products of tungsten carbide tools will not be identical, but each manufacturer will follow the methods that he deems the best.

There are at present in use throughout Europe and the United States more than 200,000 Widia tools, and it is understood that the actual production of Widia at this time is sufficient to provide cutting tips for from 20,000 to 30,000 tools per month.

Widia is produced in the form of small tips to be used as cutting edges for tools or as inserts for parts that have to withstand extreme wear or abrasion. Widia is not a cast material, but is made by forming the finely divided and carefully mixed components to the shape desired under hydraulic pressure. Afterward the material is sintered in an inert atmosphere at high temperature. It must then be ground on special wheels that have been developed for this purpose.

While in some instances it may be necessary to provide for greater speeds and more power in machine tools to obtain the full advantage of Widia and other tungsten carbide tools, it is possible to use these tools to great advantage in modern machines of the present type. In almost every machine shop, there are many machines that are not run to anything like their full capacity. These machines can be speeded up considerably and usually they have a surplus of available power. Widia and other tungsten carbide tools, when used in these machines, will greatly increase production without any change in the machine equipment.

Results Obtained Through the Use of Widia Tools in Automobile Shops

One shop in this country manufacturing automobile parts has in use more than four hundred Widia tools. This shop has ordered an additional supply of tools sufficient to tool up every machine. When this has been accomplished, the production of the entire shop will have been more than doubled, according to the estimate of the manager, on the basis of the performance of the machines already equipped. This doubled production will be accomplished without any new equipment and without hiring any additional labor. In other words, the output of the shop will be doubled through the use of Widia tools.

Another specific instance of speeding up production is in the manufacture of a transmission drum for an automobile. With the best tools previously available, this drum, which is of cast iron, cast in a permanent mold and very hard on the surface, was machined at a cutting speed of 190 feet per minute. With Widia, this is being done at 592 feet per minute. The previous production time was 78 seconds, whereas with the new material, this part is being made in 20 seconds, or practically four times as fast as before. The previous tool needed regrinding after every 25 drums machined, whereas the Widia tool only needs regrinding after every 100 drums machined. This work is done without change in equipment, other than the change to Widia tools and speeding up the machines.

In cutting hard materials, such as chilled cast iron and manganese steel, previously almost unmachineable, Widia performs spectacularly. A 12 per cent manganese steel is being machined regularly at cutting speeds of 35 feet per minute, 0.2 inch depth of cut, and 0.012 inch feed.

The Cutting of Non-ferrous Metals with Widia Tools is an Important Application

A very useful field for Widia is in machining the soft, but abrasive, materials. A particular application of this nature is in a large die-casting shop. The job is machining the fins from small aluminum die-castings. The greatest number of pieces that had ever been machined by former tools before the tool needed regrinding was 2500. A Widia tool was put on the job, and at the last report had machined 45,000 pieces, had never been out of the machine, and the edge was still in very good condition, producing a smooth finish on the work.

A manufacturer of bronze bushings reports that where Widia tools are in use, the machines have been speeded up to five times the previous speeds, and where regrinding was formerly necessary after every 15 pieces, it is only necessary to grind the Widia tools after every 500 pieces, showing savings both in speed and lasting qualities.

*Abstract of a paper read before a joint meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers and the Metropolitan and Plainfield Sections of the Society. Additional information on tungsten carbide tools will be found in the following articles previously published in MACHINERY: "How Carboloy Will Affect Tool Design," April, 1929, page 613; "Tungsten Carbide Tools for Production Work," April, 1929, page 621; "The Grinding of Tungsten Carbide Tools," March, 1929, page 536; "Carboloy and Tungsten Carbide Tools," "February, 1929, page 457; "What May be Expected from Carboloy," January, 1929, page 353; "Carboloy—A Remarkable New Cutting Alloy," November, 1928, page 214.

Widia is now replacing many diamond boring tools. Small Widia boring tools can be run at just as high a speed as the diamond tools—from 2500 to 5000 revolutions per minute, depending on the size of the hole to be bored. A beautiful mirror-like finish is produced, due to the ability of Widia to maintain its sharp cutting edge, with resulting free cutting and absence of tearing effect. Interrupted cuts, such as are encountered in split bearings, can be made without difficulty. The cost of the complete Widia boring tools is only about one-half to one-third as great as that of the complete diamond tools of the same size.

Widia Tools Can be Used to Advantage in Present Machine Tools

Much has been said about the effect of Widia upon the design of machine tools. It is true that in some instances important developments may be expected in machine tool design to meet the demands of the new cutting material. At the present time, however, in almost every machine shop, the machines are not being run to anything like their full capacity. These machines can be speeded up considerably and usually they have plenty of power. Widia tools can be used in these machines to advantage without the necessity of developing new machine tools to obtain good results from the new cutting metal.

Suggestions for the Use of Widia Tools

It is necessary to emphasize strongly that many ideas in connection with the use of high-speed steel must be revised when considering Widia. It is not a steel, contains practically no iron, and as the process of manufacture would indicate, it has a structure entirely different from steel, necessitating different methods of use. In many cases, Widia tools can be ground to the same shape as the high-speed steel tools previously used, and placed in service under similar conditions with excellent results. In other cases, given the same conditions as for high-speed steel tools, the new cutting alloy will fall down dismally, with resulting disappointment and condemnation of the material. It is unfair to select the most difficult job in the shop and place Widia tools in service under the same conditions as high-speed steel tools, and expect them to perform marvels. Rather, each job should be studied carefully, and every effort made to work out the best possible conditions.

Widia is only about half as strong as high-speed steel, and the maximum pressure of the chip on the surface of the Widia tool should be correspondingly less than the maximum chip pressure on the surface of a high-speed steel tool. Ordinarily, the pressure on a high-speed steel tool is far from the maximum allowable, the principal limiting factor being the cutting speed. In these cases, Widia tools can be used with the same feed and depth of cut, and at greatly increased cutting speed. The clearance angle of the tool should be kept within reasonable limits, so that the cutting edge will be properly supported by the steel of the shank.

In setting Widia tools for turning steel, the best results are obtained if the cutting edge is set about 1 per cent of the diameter of the work, above the center of the work being cut. For turning castings, brass, and bronze, the cutting edge should be exactly on the center line, and in boring any material, the best results have been obtained when the cutting edge is exactly on the center line of the work. Information relating to the best tool shapes and cutting clearance angles on the tools are furnished by the distributors of these tools, and their recommendations should be carefully observed.

Widia has been Used Successfully for Heavy Cuts

It should not be concluded from anything that has been said in the foregoing that it is not possible to use heavy feeds and cuts with Widia. On the contrary, very heavy cuts can be taken under the proper conditions, even when the cuts are interrupted. For example, 0.35 per cent carbon steel can be cut at 100 feet per minute, 0.2 inch depth of cut, and 0.160 inch feed, or 200 feet per minute, 0.4 inch depth of cut, and 0.060 inch feed. Chrome-nickel steel, 3 1/2 per cent nickel, 1 1/2 per cent chrome, 140,000 pounds per square inch tensile strength, can be cut at 65 feet per minute, 0.160 inch depth of cut and 0.160 inch feed; or 150 feet per minute, 0.4 inch depth of cut and 0.040 inch feed.

Stainless steel with about 18 per cent chromium and 8 per cent nickel can be cut at 115 feet per minute, 0.200 inch depth of cut and 0.040 inch feed. Cast iron of 220 Brinell hardness can be cut at 280 feet per minute, 0.700 inch depth of cut and 0.040 inch feed. Perhaps the most remarkable of all are some figures for 12 per cent manganese steel, which can be cut at 40 feet per minute, 0.2 inch depth of cut and 0.012 inch feed. The foregoing will give an idea of the feeds and cuts which can be taken at high speeds.

Slowing down in the cut, vibration, and chattering are conditions to be avoided. The machine should never be stopped with the tool in the cut and the feed on, as there is danger of breaking the Widia tip under these conditions. Widia tools should be held firmly, with short overhang, and should be supported as near as possible to the cutting edge, avoiding toolposts with sliding radial supports. The tools should be firmly clamped to a solid support whenever possible.

Widia tools are usually furnished complete, ready for use. The brazing operation requires care, and if improperly done will give the impression that the Widia is at fault, whereas in reality the trouble is with the brazing.

A sharp smooth edge is essential for best results with Widia, and this can only be obtained with special grinding wheels suitable for the pur-

The following recommendations are made for setting Widia tools for turning different materials: For steel, the best results are obtained when the cutting edge is set 1 per cent of the diameter of the work above the center of the work. For turning castings, brass and bronze, the cutting edge should be on the center line; and in boring any material, the best results have been obtained when the cutting edge is exactly on the center line of the work. The recommendations of the makers of these tools as to the best tool shapes, and cutting and clearance angles, should always be carefully observed.

pose. The grinding can be done in about the same time as is required for high-speed steel, provided the special wheels are used, running perfectly true. The grinding can be done wet or dry, but wet grinding is recommended, using a plentiful supply of water directly on the part being ground, to avoid overheating and sudden cooling. A light pressure should be used, for the same reason. Widia can be cracked and rendered useless if these instructions are not observed.

In conclusion, it should be said that Widia is not a cure-all. Where bad chattering is unavoidable, or where old machines are taking hogging cuts to the limit of their capacity when using high-speed steel tools, there is no advantage in using Widia, and often failure will be encountered. Also, there are some cases of high-speed finishing on soft steel where the advantage gained would not warrant the additional expense. Those who take a Widia tool and put it in a machine without studying the conditions, which may be suitable for high-speed steel tools but wrong for Widia tools, and expect to secure amazing results, are doomed to disappointment. They will probably condemn it without further trial. On the other hand, if the few simple facts here set forth are remembered, and Widia is placed in service under proper conditions, the results will be all that could be desired, and in many cases, beyond all expectations.

* * *

ACTION OF ACIDS ON NON-METALLIC GEARS

Non-metallic gears are more satisfactory than metal gears for applications where the atmosphere is filled with acid fumes, or where gears are subjected to direct contact with acids due to splashing. Pickling operations in the steel mills, galvanizing processes in the same industry, and various plating operations performed in different industries are examples of these applications. Although non-metallic gears are not entirely impervious to all acid solutions, experience has proved that the non-metallic material is affected less than metal and will give more satisfactory results, both in durability and performance.

In one case, both metal and non-metallic gears were tested on a plating application. The operation was so arranged that the pinion was subjected intermittently to contact with minute quantities of the plating solution. In a short time the tooth thickness of the metal pinion had increased considerably, with a corresponding lessening of the tooth spaces due to the accumulation of the plating on the surface. The non-metallic gear, however, continued to run satisfactorily.

* * *

According to the National Automobile Chamber of Commerce, the production of American automobile companies in March totaled 595,000 cars and trucks, which is 20 per cent more than any previous monthly record. The figure includes the entire industry, covering both plants in the United States and Canada and assembling plants for American cars abroad. The total production for the first three months was 1,515,000 cars, the highest on record for any quarter year.

NITRIDING PROCESS IS NOT NEW

By P. C. OSTERMAN, American Gas Furnace Co., Elizabeth, N. J.

The process of hardening steel, by means of active nitrogen, usually in the form of anhydrous ammonia, is receiving considerable attention from metallurgists, research workers, and others, because of the advantages inherent in this method of surface hardening and the characteristics of the case so obtained.

The fact that the process can be carried out at a low temperature and that the quenching operation usually required with surface hardening may be omitted, reduces distortion to a very great extent, if it does not eliminate it entirely. This means that grinding tolerances can be reduced greatly or omitted altogether, finished machining being done before the hardening operation takes place. The case obtained by this method is extremely hard; in fact, it will scratch glass without difficulty. It is also highly resistant to corrosion.

The impression has been gained by some that this process is new, which is far from being the case. Machlet patents Nos. 1,065,379 and 1,092,925 cover not only the gas carburizing process (which is too well known to need discussion) and in combination with it the nitrogenizing process, but also the nitrogenizing process of surface hardening alone, using gas as the active surface hardening agent. These patents antedate, by a number of years, any other patents referring to this process which have been granted, and it is therefore suggested that those contemplating the adoption of this process first familiarize themselves with these two patents, as complications may thereby be avoided.

The steel makers and companies specializing in the supply of alloying elements for steel are to be complimented upon the vigor with which they have pushed the development of steels suitable for nitrogenizing, and it is hoped that developments will continue at as rapid a rate as they have during the last few years. Undoubtedly, they will result in this process becoming an important one commercially at an early date.

* * *

RAILROAD EFFICIENCY HIGHEST ON RECORD

During 1928 American railroads established five new operating records as follows: (1) Fewer trains and locomotives in proportion to the amount of traffic hauled were required; (2) the average load per train was the highest ever reported, averaging nearly 3 per cent over the previous year; (3) the distance traveled each day per freight train averaged more than 307 miles, an increase of approximately 20 per cent over the performance five years ago, when the average was 259 miles; (4) the number of ton-miles moved by train per hour was greater than ever before; (5) freight traffic in 1928 was handled with the greatest conservation of fuel ever reported, the coal consumption per 1000 gross ton-miles being 125 pounds, as compared with 129 pounds during the previous years.

The passenger traffic in 1928, however, was less than for any year in the last twenty. The passenger mileage was 32.8 per cent less than in 1920, which was the record year in this respect.

USING CAPACITY CHARTS TO PREVENT OVERLOADING PRESSES

By FRANK MOSSBERG

Judging from twenty years' experience in operating presses, the writer believes that no machine tool is subjected to so much abuse as the press. The foreman and the tool setters of many plants apparently give very little attention to the capacity or size of the press when setting up for a blanking job. Often the press handles work a great deal heavier than that for which it was originally designed. This abuse might possibly be avoided by equipping all presses with safety devices, but in many cases it would be difficult to apply a device that could be depended upon.

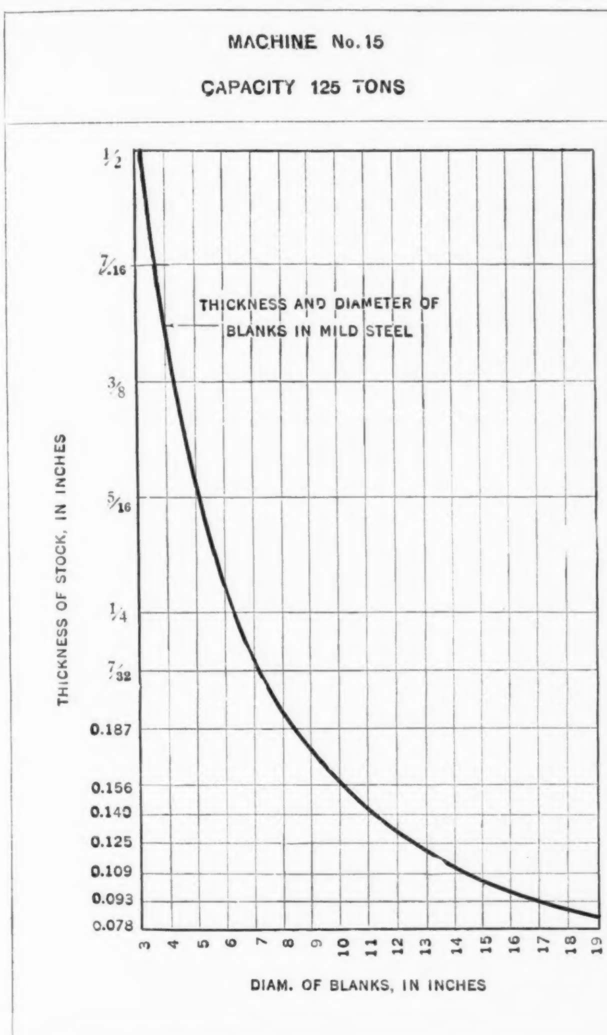


Chart Showing Capacity of Press

An easily adopted plan for preventing damage to presses through overloading, which has proved very satisfactory at the plant of the Mossberg Pressed Steel Corporation, Attleboro, Mass., is to provide each press with a capacity chart, such as shown in the accompanying illustration. The presses operated by this company range in capacity from 1400 tons down to less than one ton.

Since adopting the charts, no presses have been damaged through overloading. Each press has its own individual chart, which shows the foreman or tool setter at a glance whether or not the machine will handle a given blanking job. For example, suppose that the tool setter has to set up a die for blanking out a part 6 inches in diameter from mild steel 1/4 inch thick. By referring to the chart for machine No. 15, shown in the accompanying illustration, he finds that the work is within the capacity of the machine.

In using the chart, the tool setter locates the horizontal line opposite the given thickness of the material and follows this line along to the right to the point where it intersects the vertical line representing the blank diameter. If this point of intersection is to the left of the heavy curved line, the work can be readily handled on the machine. If the point of intersection lies to the right of the heavy curved line, the working capacity of the press will be exceeded.

* * *

INDICATING TOLERANCES ON DRAWINGS

By OSCAR W. JOHNSON

Recent articles in MACHINERY have called attention to difficulties experienced in holding work within the close limits often specified on drawings. Possibly part of the trouble is due to the method of expressing the tolerances. There are, at least, three different forms in use today, two of which may be responsible for the difficulty.

An allowable variation may be shown by dividing the total allowance into plus and minus limits, or by giving the maximum and minimum dimensions. In general, neither of these forms makes the best use of the available allowance, because it becomes the aim of the operator to machine the work to an intermediate dimension.

The third way of expressing tolerances applies all the allowance in one direction and thus practically doubles its usefulness. The principal or basic dimension is the preferable one, while the tolerance indicates the range or amount of variation. It simply means moving the range of tolerance along until all of it lies on one side of the exact dimension. On a shaft dimension this would be, for example, plus 0.000 and minus 0.002, with the plus 0.000 allowance written directly above the minus allowance. The tolerance on the diameter of the bearing for the shaft would be plus 0.002 and minus 0.000.

* * *

NEW AIRPLANE HEIGHT INDICATOR

An indicator that accurately gages the height of an airplane above the ground has been developed by E. F. W. Alexanderson, consulting engineer of the General Electric Co., Schenectady, N. Y. It is known as a radio echo altimeter. The device is provided with an indicator that shows distances above the ground up to 3000 feet. It is in the lower regions, however, that danger lies, and the greatest interest in the device centers around the fact that it will record levels down to 50 feet. At low heights, colored lights indicate the height of the plane. When a green light flashes, the pilot knows that he is 250 feet above the ground; when a yellow light shows, he is 100 feet above ground; and when a red light is turned on, he is warned that he is only 50 feet above the surface. In addition, the meter is graduated from 3000 to 200 feet, so that the pilot may read off his altitude within those limits at any time.

The British Metal-working Industries

Automobile Industry Reaches Saturation Point in Home Market—Industrial Conditions During Month Have Been Good

From MACHINERY'S Special Correspondent

April 17, 1929

WITH a General Election imminent, it would be unwise to attempt any forecast of the trend of trade conditions in the immediate future. However, the year has begun well, and in place of the shifting quicksands of labor and political unrest, a firm foundation has now been laid on which a period of trade prosperity is likely to be built. Industrial progress will depend largely on the trend of events in the next three months.

The Machine Tool Industry Remains Busy

Machine tool manufacturers continue to be well employed, and this indicates that conditions throughout the metal-working industries are improving. In recent years, there have been several short periods of improved trade, but in most cases manufacturers have not considered that the outlook justified the re-equipment of their shops on a large scale. A cautious policy has been dictated by sheer necessity, in many cases, while in others, it may well have been due to shortsightedness. However that may be, the fact that up-to-date machine tools are now being installed indicates that manufacturers have good orders on hand and considerable confidence in the future.

All sections of the machine tool industry are busy today, and manufacturers of the heavier types of machines have more work than at any time for a number of years. A fair proportion of these orders are destined for shipyard work, but the other heavy engineering industries are also placing a substantial number.

Overseas Trade in Machine Tools Declines Somewhat

Exports of machine tools in February amounted to 1219 tons, valued at £171,857. Thus there was a considerable falling off, in comparison with the exceptionally high January figures, when 1780 tons valued at £247,260 were exported. The ton value of exports, however, showed a slight increase from £139 in January to £141 in February.

Imports in February totalled 765 tons, valued at £121,487, as compared with 847 tons in January, valued at £136,838. Thus the ton value of imports showed a slight decline from £162 in January to £159 in February.

Iron and Steel Production is Satisfactory

The production of pig iron in February amounted to 519,600 tons, as compared with 563,900 tons in January, but the decrease in the total figure was due entirely to the shorter month. Actually the daily production in February, namely, 18,557 tons, was rather higher than the corresponding figure. for January. Steel production in February amounted to 782,900 tons, a figure which, in spite of the shorter month, was higher than the January total, and, indeed, higher than the total for any month since March, 1928.

The Automobile Industry and Railway Transportation

At present all motor car manufacturers are working at high pressure to cope with the seasonal demand, and recently one of the largest factories achieved a record output of 2000 cars. The total number of cars produced in this country during 1928 was 154,495, with a value of £38,763,946. Both the total number and the value were lower than in either of the two preceding years. In 1927, the output was 161,920 valued at £43,550,561, while in 1926, 158,699 cars of a total value of £43,161,945 were produced.

The average value of cars produced in 1926 was £272, and in 1927, £269. In 1928, the average value showed a sharp drop to £251, and since there were no general reductions of price during that year it is evident that the cheaper cars formed a larger percentage of the total.

From a consideration of the output figures, one is forced to the conclusion that the home market for British manufacturers is rapidly approaching the saturation point, and that the output is unlikely to increase substantially in the future. One of the chief obstacles to the sale of new cars is the congestion of the market with second-hand vehicles. The problem of the ultimate disposal of these second-hand cars is one that will have to be considered seriously in the future.

Independent manufacturers of locomotives and rolling stock are still relying, for the most part, on foreign orders, the bulk of the equipment for the home railways being produced in the shops of the latter. In recent months, a steady flow of overseas orders has been noted.

New Double-acting Diesel Engine is Developed

Further orders for destroyers in the Admiralty 1929 program have been placed with Tyneside firms, so that this district has benefited substantially. No new orders were placed with Belfast shipbuilders last month, but nevertheless, full activity is being maintained with orders in hand, and employment is higher than for some time.

In view of the important position that the motor ship now holds, it is interesting to note that Burmeister and Wain are now developing a double-acting two-stroke Diesel engine. Many engineers consider that this type of engine will be universally employed, in the future, for high powers, and the fact that such a well known firm is investigating its possibilities certainly lends weight to this view. The six-cylinder engine now being constructed is to develop 6000 H.P. at 95 R.P.M.

MACHINERY'S DATA SHEETS 153 and 154

DIAMETERS AND TOLERANCES FOR MACHINE SCREW TAPS—1

Adopted by Tap and Die Manufacturers

Size and No. of Threads	Basic		Tap Measurements—Cut (Unground) Threads					
			Major (Outside) Diameter			Pitch Diameter		
	Major (Outside) Diam.	Pitch Diam.	Minimum	Maximum	Tolerance	Minimum	Maximum	Tolerance
0–80	0.060	0.0519	0.0610	0.0625	0.0015	0.0524	0.0534	0.0010
1–56	0.073	0.0614	0.0740	0.0755	0.0015	0.0619	0.0629	0.0010
64	0.073	0.0629	0.0740	0.0755	0.0015	0.0634	0.0644	0.0010
72	0.073	0.0640	0.0740	0.0755	0.0015	0.0645	0.0655	0.0010
2–56	0.086	0.0744	0.0875	0.0890	0.0015	0.0749	0.0759	0.0010
64	0.086	0.0759	0.0875	0.0890	0.0015	0.0764	0.0774	0.0010
3–48	0.099	0.0855	0.1005	0.1020	0.0015	0.0860	0.0870	0.0010
56	0.099	0.0874	0.1005	0.1020	0.0015	0.0879	0.0889	0.0010
4–32	0.112	0.0917	0.1135	0.1155	0.0020	0.0922	0.0937	0.0015
36	0.112	0.0940	0.1135	0.1155	0.0020	0.0945	0.0960	0.0015
40	0.112	0.0958	0.1135	0.1155	0.0020	0.0963	0.0978	0.0015
48	0.112	0.0985	0.1135	0.1155	0.0020	0.0990	0.1005	0.0015
5–36	0.125	0.1070	0.1265	0.1285	0.0020	0.1075	0.1090	0.0015
40	0.125	0.1088	0.1265	0.1285	0.0020	0.1093	0.1108	0.0015
44	0.125	0.1102	0.1265	0.1285	0.0020	0.1107	0.1122	0.0015
6–32	0.138	0.1177	0.1395	0.1415	0.0020	0.1182	0.1197	0.0015
36	0.138	0.1200	0.1395	0.1415	0.0020	0.1205	0.1220	0.0015
40	0.138	0.1218	0.1395	0.1415	0.0020	0.1223	0.1238	0.0015
7–30	0.151	0.1294	0.1530	0.1550	0.0020	0.1299	0.1314	0.0015
32	0.151	0.1307	0.1530	0.1550	0.0020	0.1312	0.1327	0.0015
36	0.151	0.1330	0.1530	0.1550	0.0020	0.1335	0.1350	0.0015
8–30	0.164	0.1423	0.1660	0.1680	0.0020	0.1428	0.1443	0.0015
32	0.164	0.1437	0.1660	0.1680	0.0020	0.1442	0.1457	0.0015
36	0.164	0.1460	0.1660	0.1680	0.0020	0.1465	0.1480	0.0015
40	0.164	0.1478	0.1660	0.1680	0.0020	0.1483	0.1498	0.0015
9–24	0.177	0.1499	0.1790	0.1810	0.0020	0.1504	0.1519	0.0015
30	0.177	0.1553	0.1790	0.1810	0.0020	0.1558	0.1573	0.0015
32	0.177	0.1567	0.1790	0.1810	0.0020	0.1572	0.1587	0.0015
10–24	0.190	0.1629	0.1925	0.1945	0.0020	0.1634	0.1649	0.0015
28	0.190	0.1668	0.1925	0.1945	0.0020	0.1673	0.1688	0.0015
30	0.190	0.1684	0.1925	0.1945	0.0020	0.1689	0.1704	0.0015
32	0.190	0.1697	0.1925	0.1945	0.0020	0.1702	0.1717	0.0015

For lead and thread angle tolerances, see Data Sheet No. 154.

MACHINERY'S Data Sheet No. 153, New Series, May, 1929

DIAMETERS AND TOLERANCES FOR MACHINE SCREW TAPS—2

Adopted by Tap and Die Manufacturers

Size and No. of Threads	Basic		Tap Measurements—Cut (Unground) Threads					
			Major (Outside) Diameter			Pitch Diameter		
	Major (Outside) Diam.	Pitch Diam.	Minimum	Maximum	Tolerance	Minimum	Maximum	Tolerance
12–24	0.216	0.1889	0.2185	0.2205	0.0020	0.1894	0.1909	0.0015
28	0.216	0.1928	0.2185	0.2205	0.0020	0.1933	0.1948	0.0015
32	0.216	0.1957	0.2185	0.2205	0.0020	0.1962	0.1977	0.0015
14–20	0.242	0.2095	0.2445	0.2470	0.0025	0.2100	0.2120	0.0020
24	0.242	0.2149	0.2445	0.2470	0.0025	0.2154	0.2174	0.0020
16–18	0.268	0.2319	0.2705	0.2730	0.0025	0.2324	0.2344	0.0020
20	0.268	0.2355	0.2705	0.2730	0.0025	0.2360	0.2380	0.0020
22	0.268	0.2385	0.2705	0.2730	0.0025	0.2390	0.2410	0.0020
18–18	0.294	0.2579	0.2970	0.2995	0.0025	0.2584	0.2604	0.0020
20	0.294	0.2615	0.2970	0.2995	0.0025	0.2620	0.2640	0.0020
20–16	0.320	0.2794	0.3230	0.3255	0.0025	0.2799	0.2819	0.0020
18	0.320	0.2839	0.3230	0.3255	0.0025	0.2844	0.2864	0.0020
20	0.320	0.2875	0.3230	0.3255	0.0025	0.2880	0.2900	0.0020
22–16	0.346	0.3054	0.3495	0.3520	0.0025	0.3059	0.3079	0.0020
18	0.346	0.3099	0.3495	0.3520	0.0025	0.3104	0.3124	0.0020
24–16	0.372	0.3314	0.3755	0.3780	0.0025	0.3319	0.3339	0.0020
18	0.372	0.3359	0.3755	0.3780	0.0025	0.3364	0.3384	0.0020
26–14	0.398	0.3516	0.4015	0.4045	0.0030	0.3521	0.3546	0.0025
16	0.398	0.3574	0.4015	0.4045	0.0030	0.3579	0.3604	0.0025
28–14	0.424	0.3776	0.4275	0.4305	0.0030	0.3781	0.3806	0.0025
16	0.424	0.3834	0.4275	0.4305	0.0030	0.3839	0.3864	0.0025
30–14	0.450	0.4036	0.4535	0.4565	0.0030	0.4041	0.4066	0.0025
16	0.450	0.4094	0.4535	0.4565	0.0030	0.4099	0.4124	0.0025

LEAD TOLERANCE

A maximum lead error of plus or minus 0.003 inch in one inch of thread is permitted.

THREAD ANGLE TOLERANCE

Threads per Inch	Permissible Error in One Half Angle	Total Permissible Error in Full Angle
14 to 28	Plus or Minus 45 min.	68 Minutes
30 to 80	Plus or Minus 60 min.	90 Minutes

MACHINERY'S Data Sheet No. 154, New Series, May, 1929

New Machinery and Shop Equipment

A Monthly Record of New Metal-working Machinery, Tools, and Devices for Increasing Manufacturing Efficiency and Reducing Costs

FAY AUTOMATIC LATHE OF INCREASED CAPACITY

A larger model of the Fay automatic lathe built by the Jones & Lamson Machine Co., Springfield, Vt., is being introduced on the market. This new machine has an actual swing of 24 1/2 inches, whereas the standard Fay automatic lathe has a swing of only 14 3/4 inches. The new machine is similar in construction to the standard machine, but it is heavier, larger, and more powerful. It may be equipped, as shown in Figs. 1 and 2, for holding work between centers or for chuck work, a typical set-up of the latter type being shown in Fig. 3. The new model is particularly adapted for machining tractor parts, large automobile parts, flywheels, pipe flanges, large ball- and roller-bearing races, spur and bevel gears, and a miscellaneous variety of machine parts, such as are produced in machine tool plants and other establishments.

A complete line of tools and attachments has been designed for this new machine, similar to the equipment used on the standard Fay automatic lathe. The increased size permits additional facilities for mounting tools and attachments, thus making it possible to finish completely, in one setting, more complicated pieces than can be finished in one operation on the smaller standard machine. The new machine is easy to set up for simple work, and can therefore be used to advantage on a variety of parts made in small lots.

Special Carriage with Tools at Front and Rear

For such operations as turning the outside diameter of railway-type roller bearings, facing one end, and chamfering and rounding two surfaces at one end, roughing and finishing cuts being taken on all surfaces, the machine can be equipped with a special carriage having two sets of tools. One of these sets is located at the front of the carriage and the other at the rear. In combination with the back arm, this carriage makes it possible to take roughing and finishing cuts all over the average class of work, such as flywheels, gears, and forgings.

Double-control Former Used in Machining an Internal Spherical Surface

For machining roller-bearing races spherically on the inside, a carriage equipped with a double-control former is provided. The former-slide has two positions, one for rough-profiling the inside spherical surface with a tool mounted at the front of the carriage, and the other for finish-profiling this surface with a tool at the back of the carriage. Almost an inch of stock is removed on each side of the bore.

The forgings are about 14 inches in diameter and 5 inches wide. Although the material is a tough ball-bearing steel that can be rough-machined at only about 40 feet per minute, the forgings are roughed and finished all over in twelve minutes in both operations mentioned.

Tooling Employed in Machining an Inner Race

Fig. 3 shows the tooling used in a second operation on the inner race of a railway-type bearing. The taper hole of the race is rough- and finish-bored and one end of the piece is finished in a previous operation performed in another 24-inch Fay auto-

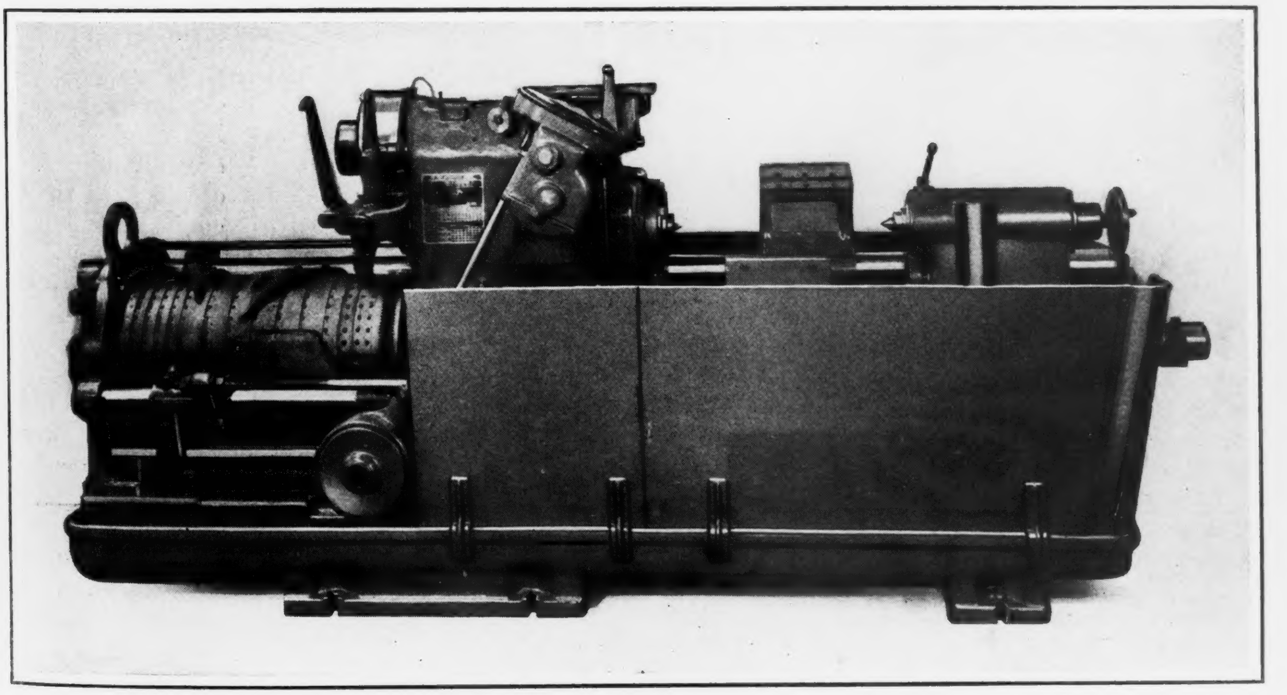


Fig. 1. Fay Automatic Lathe Having a Rated Swing of 24 Inches

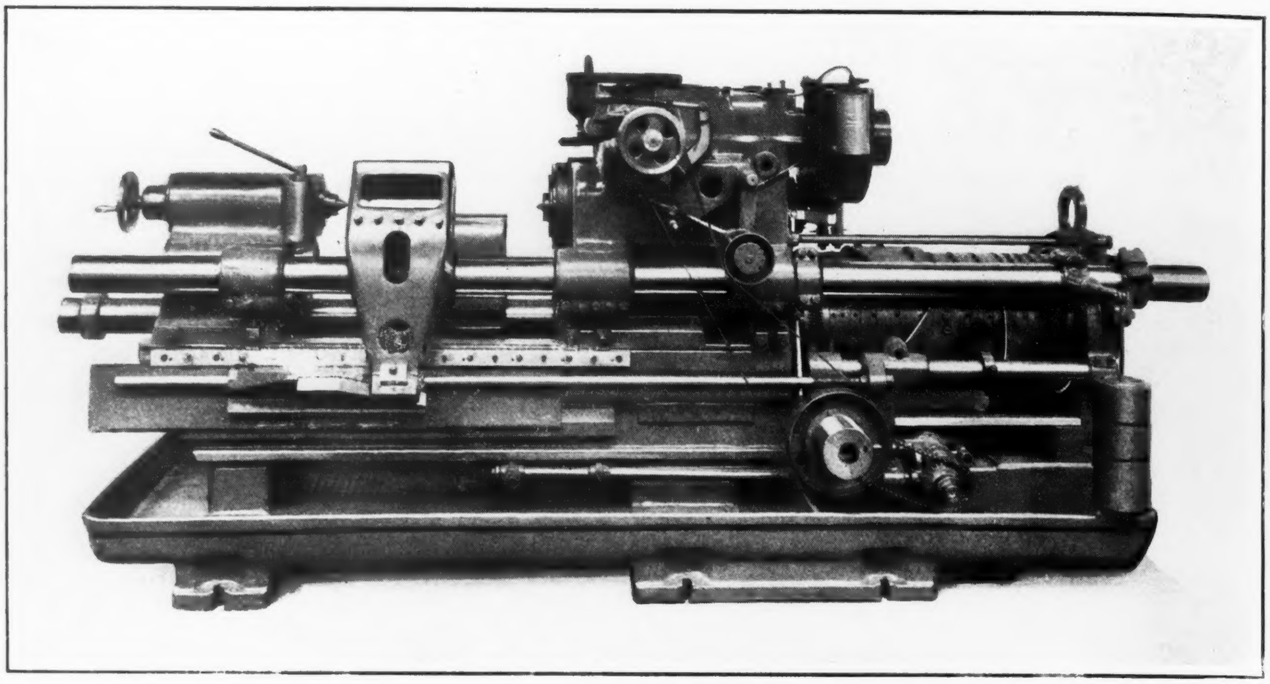


Fig. 2. Rear View of Fay Automatic Lathe, with Guards Removed to Show the Back Arm, Former-slide, etc.

matic lathe. In the operation here shown, the piece is held on an air-operated expanding fixture. Tools at the front of the carriage rough-turn the various steps on the outside of the race, while a tool held by the back arm rough-faces the outer end. The carriage is then rocked forward so that three tools at the back of the carriage may finish-turn each of the three lands on the outside of the piece on the return stroke of the carriage. During this time the two circular form tools seen on the back arm just above the work-holding fixture finish-form the large raceways. Simultaneously, the tools in the overhead slide face the under-cuts on the flanges adjacent to the raceways, and another tool in the back arm finish-faces the end of the piece. In the meantime, additional tools in the carriage have roughed and finished the chamfers at the end of the hole and on the outside of the piece.

This operation illustrates the large number of tools that can be brought into action at the same time, and indicates the heavy cuts that may be taken. This race is also made of a tough ball-bearing steel, and the operation is completed in about twelve minutes.

As seen in Fig. 1, the machine has a bed long enough to permit work up to 24 inches long to be held between centers. The tailstock ram is 6 inches in diameter, and carries a heavy-duty revolving tailstock spindle, mounted in special precision-type ball bearings. This ram may be either lever- or screw-operated. The headstock spindle has an 11-inch flange with a taper pilot. Fixtures, chucks, and faceplates are bolted to the outer section of the flange, and located by having a tight draw fit on the pilot.

The cam drum is 18 inches in diameter, and thick hardened-steel cams are used both on the inside and outside. The center bar and back bar, which are 4 1/2 inches in diameter, extend the whole length of the machine giving maximum rigidity to the carriage and back arm. The headstock may be equipped with the automatic speed-shift mechanism which changes spindle speeds automatically during the operation of the machine, or it may be equipped with a sliding-gear transmission, in which case spindle speeds to suit the work are set by hand before the machine is started. The type of transmission supplied depends upon the class of work to be operated on. As shown in the illustrations, the machine is approximately 10 feet long over all, and 4 feet wide.

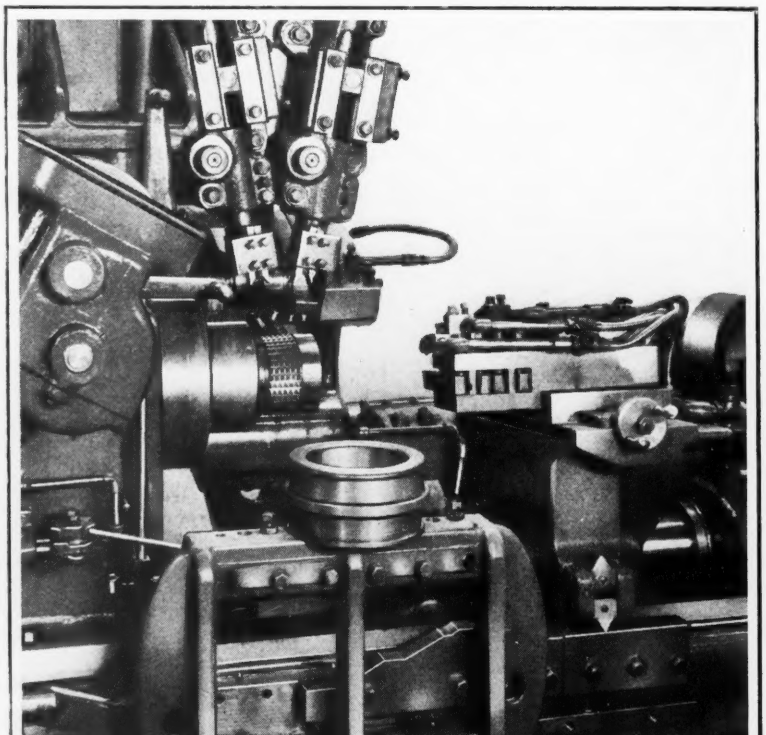
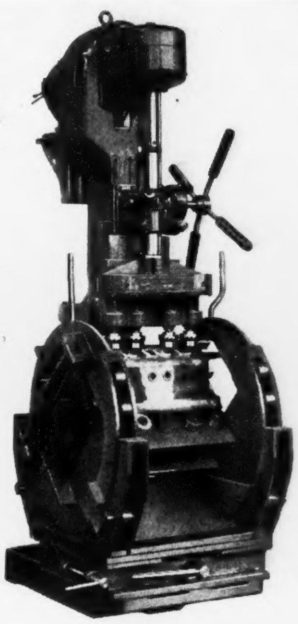
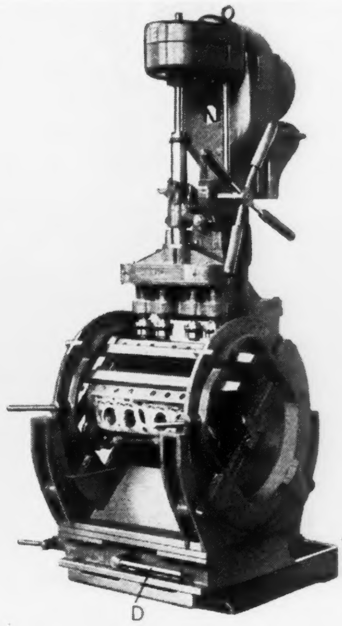


Fig. 3. Tooling Used in Machining Outside Surfaces of Large Roller-bearing Inner Races





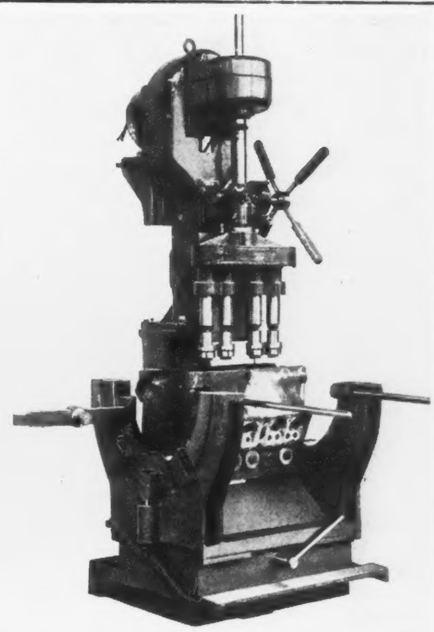


Fig. 1. Cincinnati-Bickford Cylinder-bore Chamfering Machine

Fig. 2. Position of Work Cradle for Chamfering Second Group of Bores

Fig. 3. Machine Used for Chamfering the Bottom Ends of the Bores

CINCINNATI-BICKFORD CYLINDER-BORE CHAMFERING MACHINES

Equipment for chamfering the cylinder bores in a V-type eight-cylinder engine block has recently been brought out by the Cincinnati-Bickford Tool Co., Oakley, Cincinnati, Ohio. This equipment consists of Cincinnati-Bickford "Direct Drive" upright drilling machines arranged as shown in the accompanying illustrations. The V-type eight-cylinder block comes to these machines on a roller conveyor for chamfering operations at the top and bottom of the bores after the cylinders have been rough-bored and the blocks planed.

With clamp *A* of the first machine turned back, as shown in Fig. 4, the cylinder block is pushed into the cradle fixture from the right. It is located by means of a stud *B*, parallel guides *C* above the block, and the clamp *A*. After the cradle fixture has been loaded while in the position illustrated in Fig. 4, it is revolved 45 degrees to the position shown in Fig. 1. Four of the cylinder bores are next chamfered simultaneously by means of the tools attached to the four-spindle drill head.

Upon the completion of the chamfering operation at the top of these four cylinder bores, the fixture is indexed forward through 90 degrees to the position illustrated in Fig. 2, and is then shifted laterally by operating lever *D*. The four cylinder bores of the second group are next chamfered, after which the fixture is turned back to the position shown in Fig. 4 for reloading. The bottom ends of all cylinder bores are chamfered by using a similar unit, which is shown in Fig. 3.

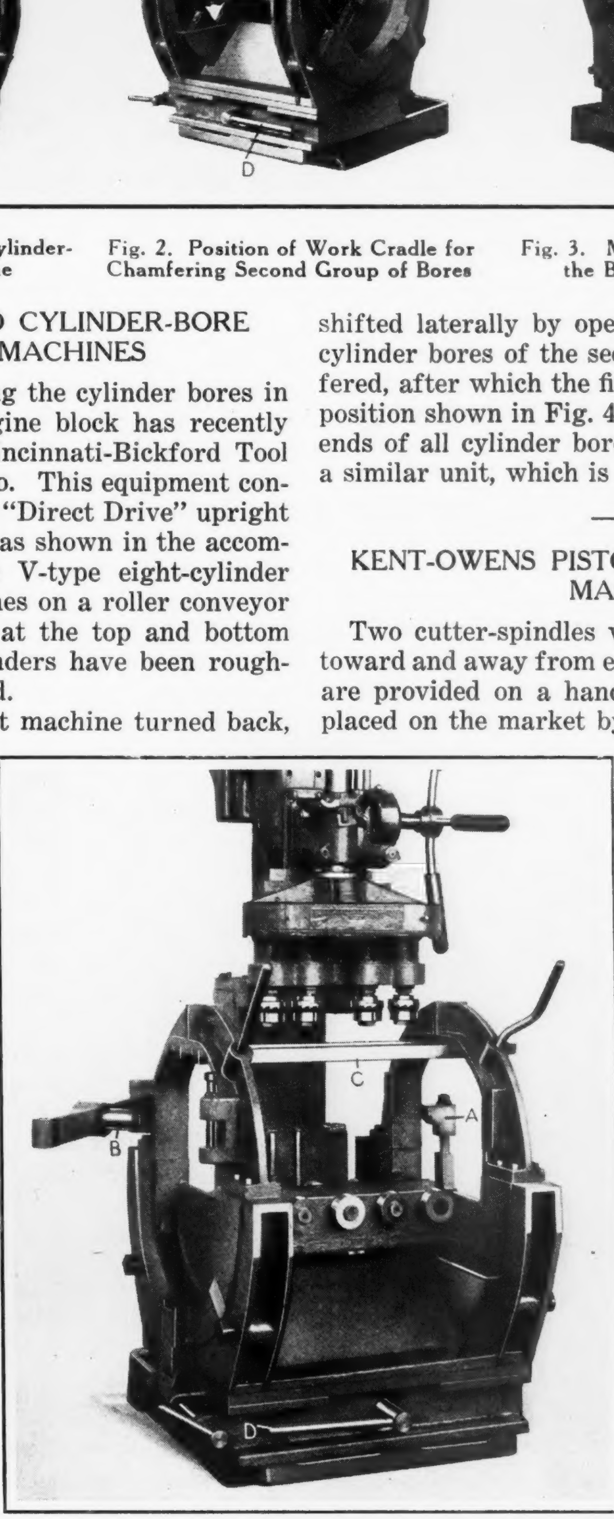


Fig. 4. Cradle in Position to Receive a Cylinder Block

KENT-OWENS PISTON-SLITTING MILLING MACHINE

Two cutter-spindles which move simultaneously toward and away from each other in a vertical plane, are provided on a hand milling machine recently placed on the market by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio. While this machine is especially adapted to slitting the skirts of automobile pistons, it may be used for many similar operations. Both slots can be milled in aluminum pistons at rates ranging from 600 to 1000 pieces per hour, depending upon the size of piston being handled.

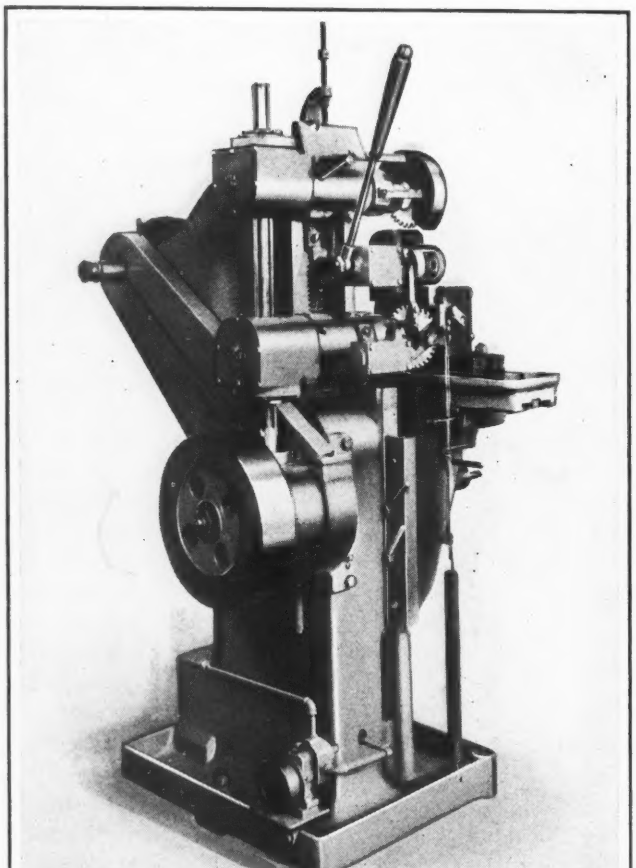
The two cutter-heads of the machine are moved toward and away from each other by operating the hand-lever, a counterbalanced feed arrangement making the operation easy and rapid. Both cutter-spindles and the back-shaft are mounted on Timken tapered roller bearings to permit the use of the high speed required for small diam-

eter cutters and for milling brass, aluminum, and other soft materials. A flywheel insures smooth operation. The cutter-spindles are driven through a long splined shaft and spiral bevel gears mounted on ball bearings. Either a belt or motor drive can be supplied. For a motor drive, a motor of from 3- to 5-horsepower rating is recommended for average conditions. Power is delivered from the motor to the machine through a silent chain.

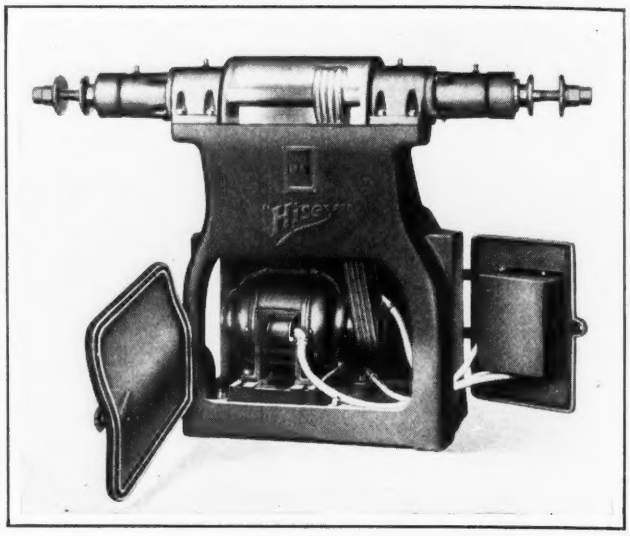
In the illustration, the machine is shown equipped with a work fixture for automobile pistons. In loading the fixture, the piston-pin holes are slipped over a projecting pin on the fixture, until the rear side of the piston rests in a vee. Then when the operating lever of the machine is pulled downward to feed the cutter-heads toward each other, a jaw beneath the piston is raised automatically to clamp the work. This clamping action occurs before the cutters reach the work.

A stop on the threaded rod seen projecting above the machine may be set to regulate the movement of the cutters to insure the proper depth of cut. When the operator reverses the movement of the lever at the end of an operation, to withdraw the cutters, the work is automatically released to facilitate reloading. While table movements are not used in machining pistons, they can be employed for other jobs.

The minimum distance between the cutter-spindles of this machine is 4 3/4 inches, and the maximum distance is 12 1/2 inches. There is a horizontal table feed of 4 inches, by means of a hand-lever, and of 17 inches, by means of a crank. The cross saddle feed is 5 inches.



Kent-Owens Two-spindle Hand Milling Machine Arranged for Slitting Automobile Pistons



Hisey-Wolf Polishing and Buffing Machine with "Texrope" Drive

HISEY-WOLF BUFFING AND POLISHING MACHINE

A buffing and polishing machine with "Texrope" drive has been brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The motor is mounted horizontally with a four-point bearing on a flat cast-iron base, which is attached to the main frame. The base has planed ways on which the motor slides, so that it may be moved as required to obtain proper belt tension. Large doors give easy access to the motor.

The motor starter is mounted on the inside of the door, and is easily accessible by simply opening the latter. The starter is automatic, providing protection from low voltage, phase failure, and overload. The switch is mounted on the inside of the base, and the starting button is flush with the top front of the column, to provide protection for the button.

The spindle is of one-piece construction and is made of nickel steel. It is mounted in two ball bearings at each end, but Timken tapered roller bearings will be substituted if desired. Labyrinth seals on the covers of the bearing housings protect the bearings from dust and dirt. Oil chambers are filled through conveniently located cups, and gages insure the escape of excess oil through an overflow vent, at the same time automatically indicating the oil level.

A key extending along the entire base of the bearing housing slides in a keyway on the top of the column, assuring rigidity of the spindle mounting and accuracy in alignment. The base, which is of gooseneck design and made in a one-piece casting, is especially heavy to eliminate vibration. This design is also convenient for the operator.

EXCELSIOR GRINDING, POLISHING AND BUFFING MACHINES

Flat or semi-flat parts may be ground, polished, or buffed in a continuous manner on an automatic rotary-feed type of machine recently brought out by the Excelsior Tool & Machine Co., East St. Louis, Ill. As shown in Fig. 1, this No. 26 machine has four grinding or polishing wheels and a circular

feed table 72 inches in diameter by 10 inches wide. Castings, forgings, and stampings are finished by placing them in magnetic chucks or other fixtures on the revolving feed table which carries them past the wheels. The rough and finished parts are inserted and removed from the same position by one operator, if four wheels are used for the operation. However, if only one or two wheels are necessary to obtain the desired finish, the capacity of the machine may be increased by placing an operator at each wheel or at every other wheel.

The wheel-spindle, guard, wheel-truing attachment, and belt-tightening device of each unit are self-contained and, therefore, the units can be adjusted to set the wheels at an angle. The speed of the wheels can be changed from 1800 to 3000 revolutions per minute by changing the motor pulleys. Each unit is balanced by adjustable weights, so that any desired pressure can be applied to the corresponding grinding wheel. At the same time, the wheels are free to rise if the material being ground is of uneven thickness, thereby relieving them of any undue pressure. The units slide on upright shafts secured to the upper and lower housings of the machine.

The feed table is driven by an internal gear and a pinion which receives power from a worm-gear speed reducer driven through belting by a motor. The height from the table to any wheel is adjustable by turning the handwheel in front of the corresponding unit. Wheels can be raised off the work and automatically locked to permit changing them without interfering with production.

All working parts of the machine are of dust-proof construction. The wheels are furnished with dust hoods and flexible spouts connected to the upper suction pipe, to suit the work and wheels used. The machine weighs approximately 12,000 pounds.

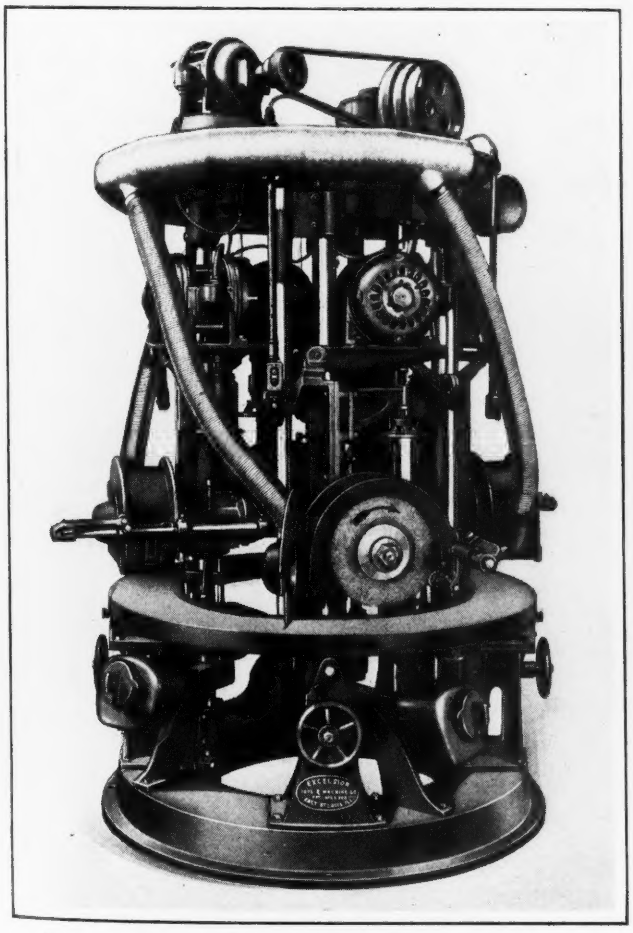


Fig. 1. Excelsior Continuous Rotary-feed Grinding, Polishing, and Buffing Machine

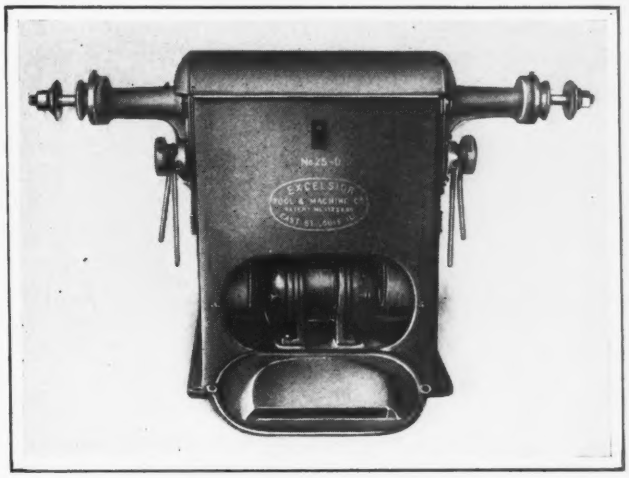


Fig. 2. Excelsior Double-spindle Motor-in-base Buffing and Polishing Machine

Fig. 2 shows a No. 25-D double-spindle motor-in-base polishing and buffing machine also recently placed on the market by this concern. One of the features of construction of this equipment is the small number of revolving parts. Since there are no operating parts between the motor and the two spindles, only the motor and spindles require lubrication. Spindle speeds can be changed from 1500 to 3000 revolutions per minute. As the spindles are independent of each other, they can be operated at different speeds, one for polishing and the other for buffing. Any type of motor can be installed.

On the back of the housing there is a retainer shelf for abrasive compound, which is handy for both operators. There is an extension on each side of the housing for attaching dust hoods or collectors. Wheels 16 inches in diameter with a 4-inch face or less can be used. The weight of the machine complete is about 1400 pounds.

"LANDMATIC" FLOATING-TYPE DIE-HEAD

The principal difference between the F type "Landmatic" die-head, recently placed on the market by the Landis Machine Co., Waynesboro, Pa., and other "Landmatic" die-heads is that the new type floats or "flexes" on the shank. This feature allows the die-head to center itself around the stock so that it will produce a full thread, even though the stock revolves eccentrically. The die-head is made primarily for application to turret lathes and hand-operated screw machines. The flexible condition is controlled by two springs which always return the die-head to the central position when it is not thrown off center to compensate for irregularities in the work. With this new tool, therefore, threads can be produced that are full and correct, regardless of whether the stock runs out of line, as is the case when the stock is slightly bent, when the turret and spindle of the machine are out of alignment, or when the gripping mechanism holds the stock off center.

The locking mechanism of the die-head is independent of the shank. This mechanism floats with the front unit of the head, and is not disturbed

when the head "flexes." Driving torque is transmitted directly from the die-head body to the shank or driving member. Automatic opening of the die-head is accomplished by merely stopping the forward movement of the carriage, and it is closed by hand.

As with all die-heads made by this concern, the chasers are supported on the face. The principal advantages claimed for this arrangement are a maximum amount of chip clearance and convenient access to the chasers when removing them for grinding. This construction also permits the use of a chaser having an unusually long life. The adjusting worm is under proper turning tension at all times, thus eliminating the necessity of locking the worm after each adjustment for size.

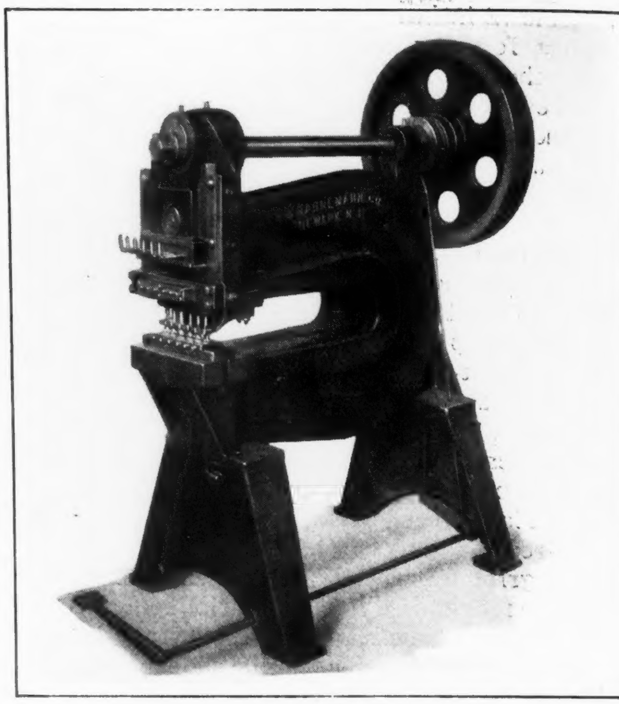
ZEH & HAHNEMANN MULTIPLE-DIE PUNCHING PRESS

A multiple-die punching press with nibbling attachment has been placed on the market by the Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J. This machine is provided with six punches and dies, any of which may be selected and brought into individual action by pressing a corresponding button. The punches and dies are 1/8, 1/4, 3/8, 1/2, 5/8, and 3/4 inch in diameter, respectively.

The nibbling punch and die can be quickly inserted, and a cutting speed up to 36 inches per minute is obtainable. Shapes and openings of any form may be cut with this attachment. The machine is treadle-controlled, and stops automatically at the high point of the stroke.

Strippers are so arranged as to allow the use of so-called "horseshoe" gages. A master templet with gaging points may be clamped to the sheet or pack of sheets to be punched, and all holes can be punched in accurate position without previous marking.

The machine has a maximum capacity for punching 3/4-inch holes in 3/16-inch steel. The throat is 24 inches deep, enabling holes to be punched in the center of a 48-inch sheet. The size of the driving wheel is 26 by 4 inches, and the speed, 120 revolutions per minute. The weight of the machine is 2500 pounds. It can be furnished with a direct-connected one-horsepower motor if desired.



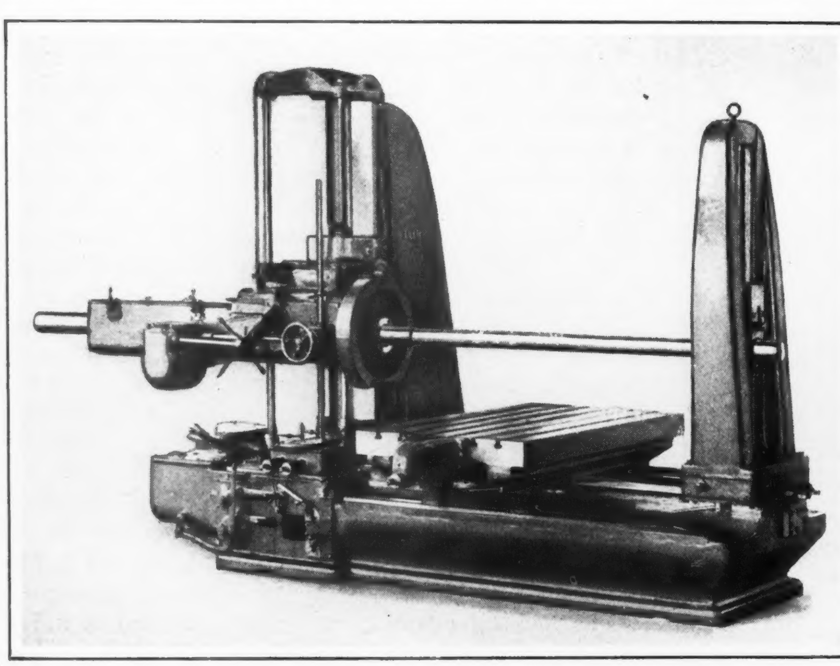
Zeh & Hahnemann Multiple-die Punching Press

DEFIANCE HORIZONTAL BORING, MILLING, DRILLING AND TAPPING MACHINE

An improved No. 6 horizontal boring, milling, drilling, and tapping machine has been brought out by the Defiance Machine Works, Defiance, Ohio. Among the features included in the design are an independent rapid traverse to the head and platen in all directions, with motions at the rate of 84 inches per minute; a completely enclosed head and feed and speed boxes with forced-feed lubrication; ball thrust bearings for the spindle; and roller bearings for the feed and speed boxes.

All levers and handwheels are in a central position convenient to the operator. One lever controls the revolutions of the main boring spindle in both directions, for tapping operations. The machine is provided with an interlocking device for the quick traverse and the power feed. A faceplate or back-gear drive is recommended when using milling cutters over 10 inches in diameter. The base is provided with outboard supports giving a maximum width of 54 inches, rollers under each end of the platen riding on a steel track to provide support.

The diameter of the spindle is 4 1/2 inches, and it has a No. 6 Morse taper hole. The travel of the



Defiance Horizontal Boring, Milling, Drilling, and Tapping Machine

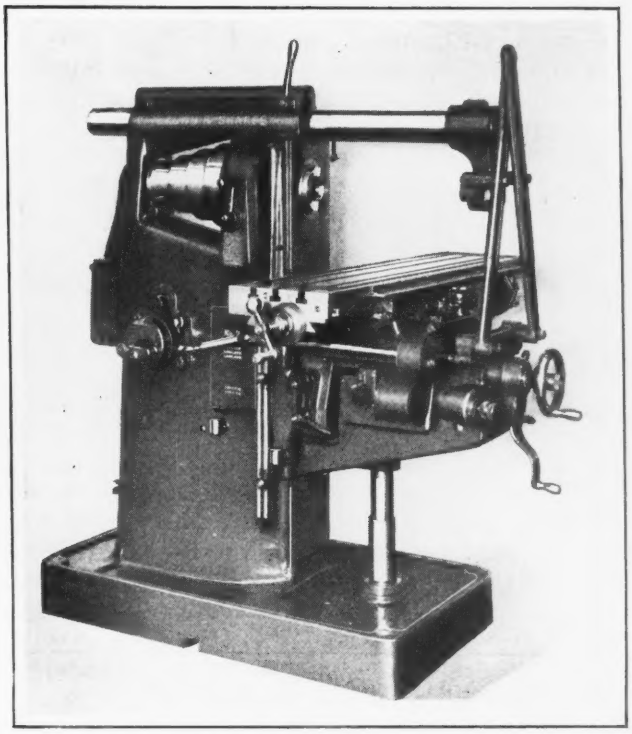
spindle is 60 inches. The machine has ten speed changes without the faceplate drive, and twenty speed changes with this drive, the range of the speeds being from 3 3/4 to 157 revolutions per minute. The feed changes, without the faceplate drive are twelve, and with this drive, twenty-four, the feed range in the former case being from 0.006 to 0.495 inch per spindle revolution, and in the latter, from 0.006 to 0.990 inch. A 10-H.P. motor, running at 1200 R.P.M. is recommended.

The machine is built with three different column heights, giving maximum distances from the top of the platen to the center of the spindle of 37, 48, and 60 inches. It is also built with four different lengths of bed, providing maximum distances from the nose of the spindle to the face of the tail support of 7, 8, 9, and 10 feet. The working surface of the standard platen is 36 by 75 inches, but larger platens can be supplied. The machines weigh from 31,400 to 37,200 pounds, according to size.

BROWN & SHARPE "STANDARD" MILLING MACHINES

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently broadened its line of milling machines by the addition of a No. 2 "Standard" universal and a No. 2 "Standard" plain machine. Articles relating to larger motor-driven "Standard" milling machines have appeared in MACHINERY for February, 1928, page 474, and September, 1928, page 69. The new machines are of the cone-drive type and are particularly intended for tool-room installation and for light manufacturing use. Power is furnished through the cone pulley, which is mounted on a sleeve on the machine spindle. A fast and a slow series of spindle speeds are available, the slow series being obtained through back-gears engaged by a lever on the left-hand side of the machine.

Two operating positions are provided, one at the front and one at the rear of the table, all levers controlling the operation of the machine being available from either position. Changes in the power feed of the table are made by rotating either of the feed-change levers located at the two operating positions. The rate of feed engaged is shown on both of the direct-reading dials. These dials are set at an angle to facilitate quick reading and are provided with glass windows which prevent clogging by chips or dirt.



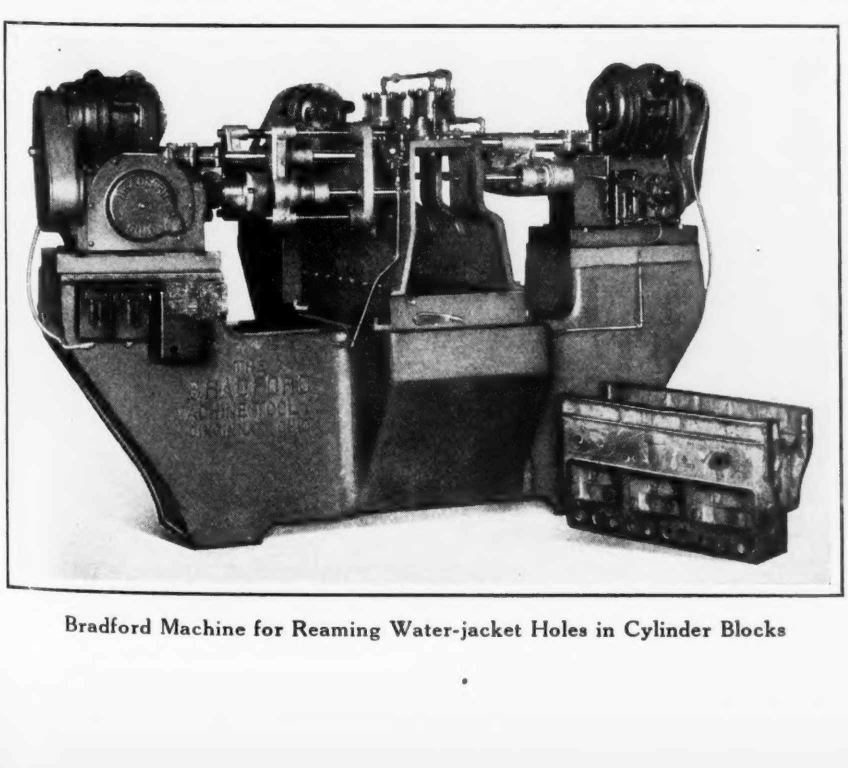
Brown & Sharpe No. 2 "Standard" Milling Machine Built in Plain and Universal Styles

Filtered oil is automatically supplied to all bearings within the column by a plunger pump. Another pump automatically lubricates the knee mechanism, while a large well at the front of the saddle oils the saddle mechanism and the table bearings. The over-arm is clamped at two points by a lever.

BRADFORD THREE-WAY REAMING MACHINE

Seven water-jacket holes are reamed at the same time in an automobile cylinder block by means of the three-way horizontal type machine illustrated, which was recently built by the Bradford Machine Tool Co., 671 Evans St., Cincinnati, Ohio. This machine was designed for use in connection with a shop conveyor system which delivers the cylinder blocks to the front of the machine on a level with the bottom of the machine fixture.

The operator slides each cylinder block from the conveyor onto the hardened guide strip at the bottom of the fixture, locating the work in position by means of pins which enter dowel holes in the flange of the cylinder block. The dowel-pins are lifted into position and withdrawn by operating the hand-lever at the front of the fixture. Two air-actuated rams, controlled by means of the valve on top of the fixture, clamp the work.

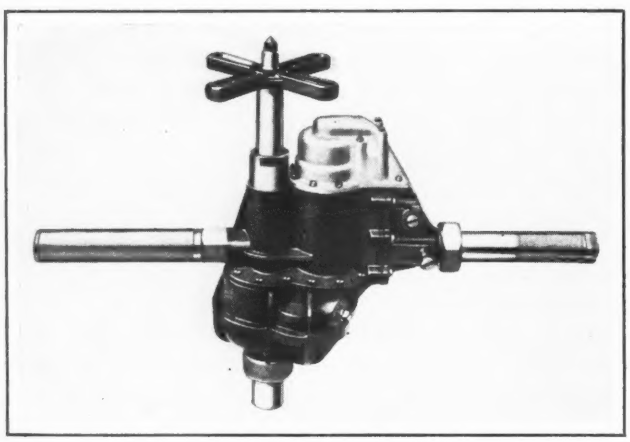


Bradford Machine for Reaming Water-jacket Holes in Cylinder Blocks

The feeding mechanism of all three heads is tripped simultaneously from the control valve on one side of the fixture, the air-controlled tripping mechanism being visible on the right-hand head. In this operation, the water-jacket holes are reamed to 0.943 inch in diameter, approximately 1/32 inch of stock being removed on the diameter of the holes. The spindles run at a speed of 350 revolutions per minute. On these cast-iron cylinder blocks, the machine time is 16 seconds, the handling time 14 seconds, and the total time 30 seconds.

ROTOR PORTABLE AIR DRILL

A type E-5 portable pneumatic drill, intended for heavy-duty drilling of holes from 29/32 to 1 1/4 inches in diameter, for reaming holes from 11/16 to 13/16 inch in diameter, and for heavy nut setting, has been brought out by the Rotor Air Tool Co., 5905 Carnegie Ave., Cleveland, Ohio. In designing this tool, the aim was to combine simplicity,



Rotor Heavy-duty Light-weight Air Drill

low maintenance cost, and smooth operation without vibration.

A new governor automatically prevents racing at idle speeds and reduces air consumption to a minimum. The governor maintains correct working speeds of the spindle for different applications. The rotor motor has only three moving parts; power is transmitted from it through compound gears, three speeds of 220, 280, and 350 revolutions per minute being provided. Positive lubrication is insured by means of an oil reservoir in the body. The feed-screw has a travel of 3 1/2 inches. The tool weighs 22 pounds.

MURCHEY NON-ROTATING SELF-OPENING DIE-HEADS

Two self-opening die-heads for use on non-rotating machine members have recently been added to the line of die-heads made by the Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich. The new die-heads have been designed as companion tools for rotating types of Murchey die-heads, so that one stock of chasers can be used on both live and stationary spindles.

The Murchey type P non-rotating self-opening die-head shown in Fig. 1 is designed principally for use on turrets of Brown & Sharpe Nos. 0 and 2

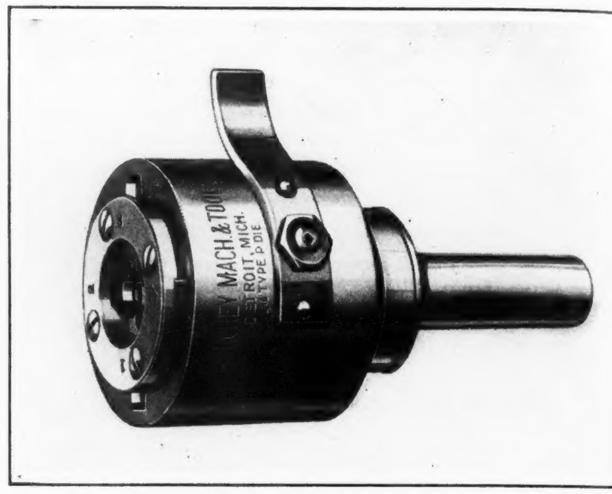


Fig. 1. Murchey Type P Non-rotating Self-opening Die-head

automatic screw machines. This die-head is made in 7/16-, 9/16-, and 1-inch sizes, and will take the same chasers, size for size, as the types O, CO, and G die-heads, as well as many of the same parts. A cam serves to close the die when a rotary motion is imparted to the shell by a closing arm which engages a trip placed on the bed of the machine.

The die-head is adjustable for thread length, and is opened automatically by a self-contained trip, when the proper length of thread is cut. The instantaneous action of this trip insures a straight thread, and especially adapts the die-head for cutting short threads. The head is so designed that the chasers can be readily changed without removing the cap or taking the die-head from the spindle of the machine.

The Murchey type G non-rotating self-opening die-head, shown in Fig. 2, is designed for use on turret lathes of all types and automatics such as the Potter & Johnston, Cleveland, and similar types. This die-head is made in sizes ranging from 7/16 inch up to and including 5 inches. The chasers used in the types O, CO, and P die-heads can be used in the corresponding sizes of this new die-head. Many other parts of the rotating and non-rotating types of die-heads are interchangeable.

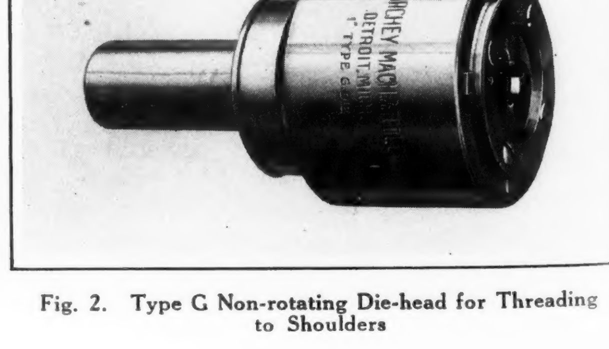
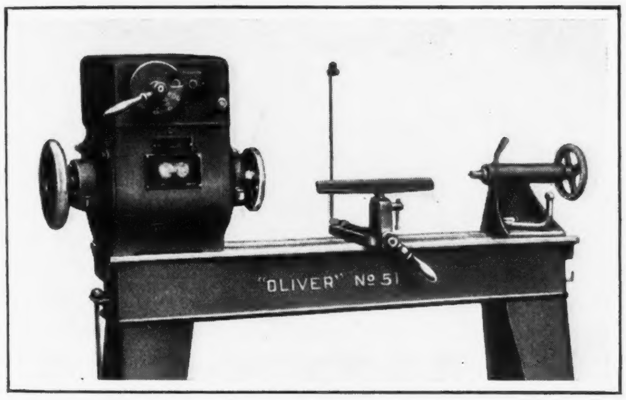


Fig. 2. Type G Non-rotating Die-head for Threading to Shoulders

The new die-head is opened by a self-contained trip, and is closed automatically when the closing handle engages a stop on the machine or is operated by hand. The principal feature of the type G die-head is the trip employed, which especially adapts it for shoulder threading where the threads are to be cut to precise lengths. The chasers of this die-head can also be readily changed without removing the die-head from the machine spindle.

OLIVER MOTOR-HEADSTOCK SPEED LATHE

A speed lathe equipped with a unit-type motor headstock has been added to the line of speed lathes built by the Oliver Machinery Co., Grand Rapids, Mich. A 1/2-horsepower four-speed motor, its control and protective devices, together with the starting button and lever with which the full-load speeds of approximately 600, 1200, 1800, and 3600 revolutions per minute are controlled, comprise the complete headstock unit. This new unit can be readily removed from the lathe and forms a convenient means for modernizing old belt-driven speed lathes, as it can be readily substituted for the old-type headstocks. One of the safety features claimed for this equipment is that the motor can be started at low speed only, although it can be stopped at any speed.

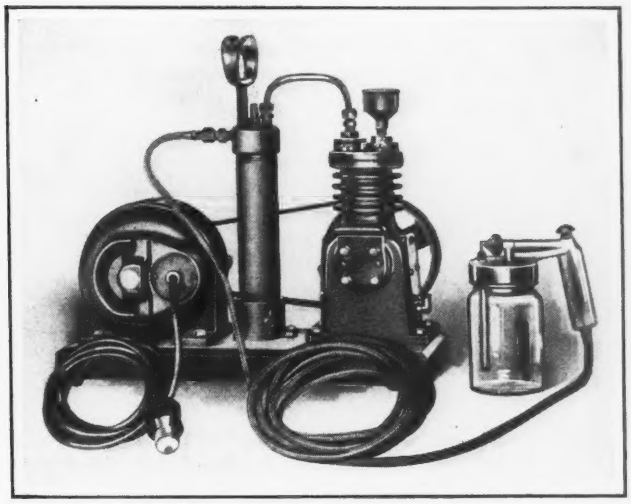


Oliver Speed Lathe Equipped with Unit-type Motor Headstock

The spindle, which is the only rotating part, is mounted in ball bearings which take end thrusts in both directions, thus meeting all requirements for faceplate turning and turning between centers. The control mechanism is built into the top portion of the headstock housing and is readily accessible by removing a cover held in place by four screws.

DEVILBISS SPRAY-PAINTING OUTFIT

A type NC-601 spray-painting and finishing outfit intended for use in machine shops, service shops, garages, etc., has been brought out by the DeVilbiss Co., Toledo, Ohio. This equipment is self-contained, simple, and is furnished complete with an air compressor, ready for use. In using, the operator merely puts the material into the paint container, plugs the electric connection into a light socket, and starts working. The paint is delivered as a finely atomized spray, adjustable from a round spray to a fan spray, 3 1/2 inches in width. The air supply is ample and the pressure is always constant. The outfit weighs 47 1/2 pounds, and may therefore be moved from place to place without difficulty.


De Vilbiss Spray-painting Outfit

TOLEDO AUTOMATIC COUNTING SCALE

Quantities of small objects, such as bolts, screws, and pins may be quickly counted by the use of an automatic scale, recently added to the products of the Toledo Scale Co., Toledo, Ohio. As may be seen in the illustration, this scale or instrument has three pans or scoops, a large one which holds the objects to be counted, a right-hand small scoop which has a ratio of 99 to 1 relative to the large scoop, and a left-hand small scoop which has a ratio of 9 to 1 with respect to the large work-holding scoop. The indicator moves over a large face, which is clear except for a zero mark flanked by the words "over" and "under."

Parts loaded in the large scoop are counted by taking not more than nine pieces of work at a time from this scoop and placing them into the small ratio scoops until the indicator coincides with the zero mark. For each part placed in the right-hand pan, 100 parts are counted, and for each part put

Toledo Scale for Counting Large Quantities of Small Parts

into the left-hand pan, ten parts are counted. Thousands of small objects can thus be accurately counted in a few seconds. The scale has a capacity for 40 pounds of work.

LAKESIDE DRILLING, REAMING AND COUNTERSINKING MACHINE

A drilling, reaming, and countersinking machine designed to be mounted on a structural steel boom which, in turn, is supported by cast-iron wall brackets, is a recent development of the Lakeside Bridge & Steel Co., 100 Villard Ave., Milwaukee, Wis. The illustration shows a battery of these machines installed in a structural steel fabricating shop. Booms are made in standard lengths of from 10 to 20 feet, and special lengths can be made to suit requirements.

The machine itself comprises a cast frame on which a motor is mounted. Power is transmitted direct through gears to the main spindle, which runs in an oil bath. Three speeds of approximately 80, 115, and 170 revolutions per minute are obtainable through change-gears.

The spindle has a vertical movement of 11 inches, and a five-point adjustment permits an additional 11 inches of vertical positioning. A vertical adjustment unit can be furnished to take care of even greater variations in working heights. The spindle is bored to receive a No. 4 Morse taper shank. The feed-lever is counterweighted and can be adjusted to permit the spindle to be moved vertically without excessive energy on the part of the operator. Either an alternating- or a direct-current motor can be furnished.

It is stated that a capable operator can drill, on an average, 125 holes 7/8 inch in diameter per hour through 5/8-inch metal with this equipment, and can ream or countersink an average of from 250 to 300 holes per hour.

THIEL DIE FILING AND SAWING MACHINES

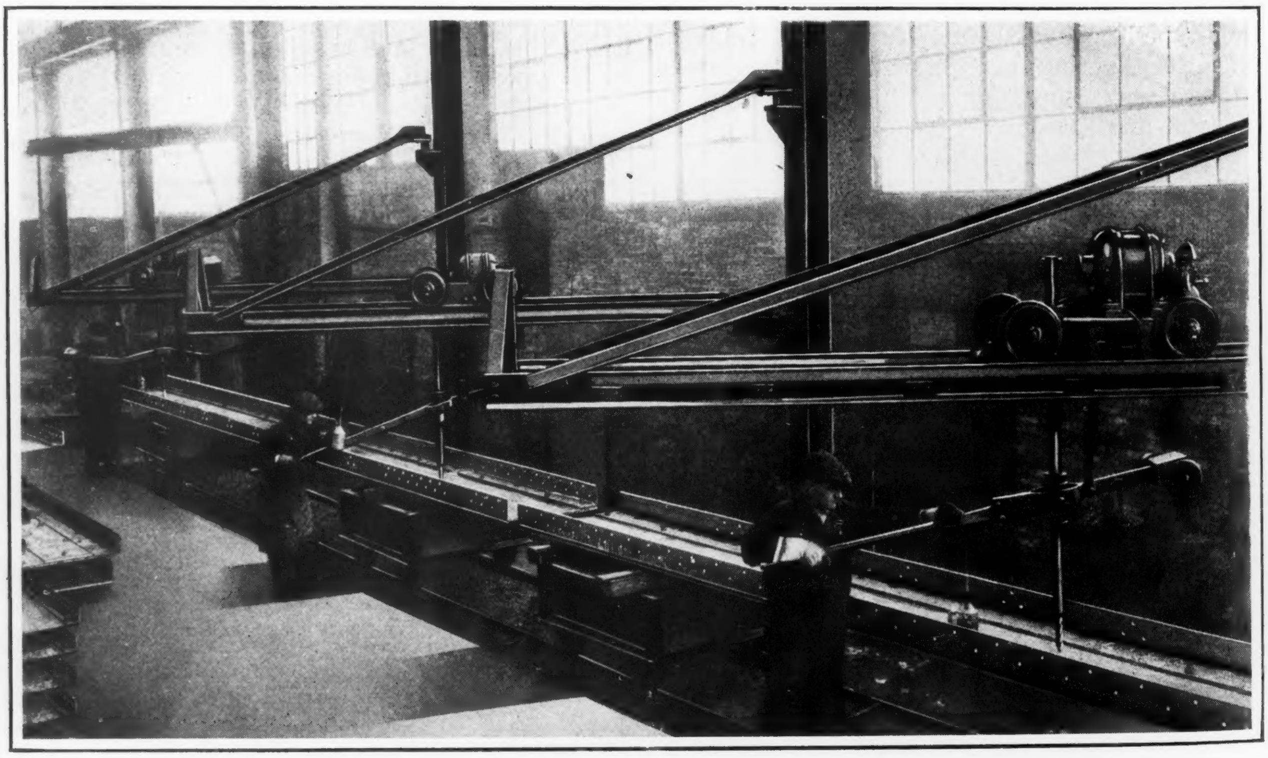
Precision die filing and sawing machines designed for sawing out and finishing small irregular holes in making jigs, punches, dies, cams, templets, etc., are being introduced on the market by Marburg Bros., Inc., 90 West St., New York City. These Thiel improved machines are made in three standard sizes, the smallest and largest of which accommodate work up to about 2 and 5 inches in thickness, respectively.

Files and saws are supported in these machines by upper and lower arms mounted on a reciprocating spindle which is held in bushings above and below the work-table. This construction is claimed to insure accurate guidance of the files and saws and to permit rapid operation. The holding frame formed by the two arms and a part of the spindle can be shortened or lengthened to suit operations by adjusting the position of the upper arm on the spindle.

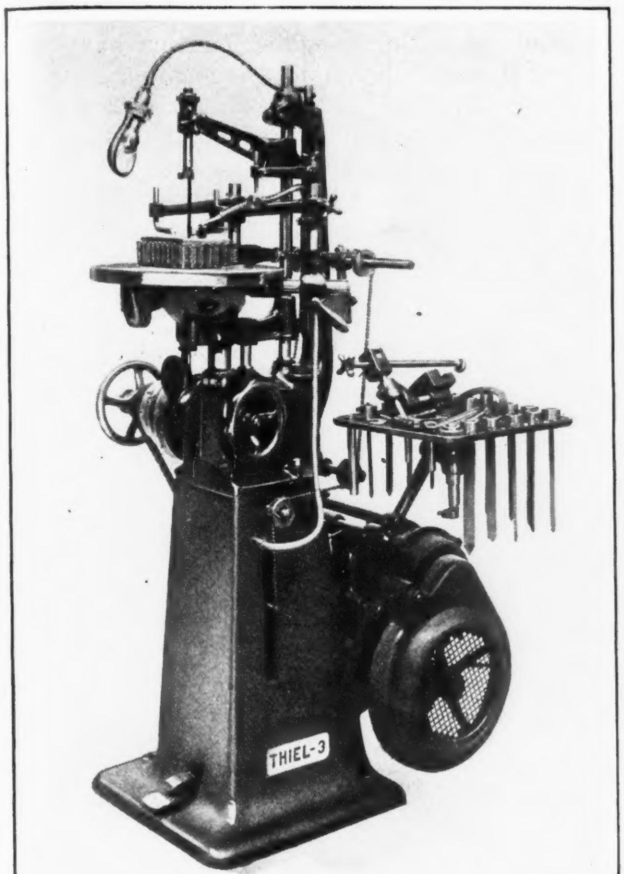
Saws and files of a large variety are kept in stock for use with the machines. The manner of holding the files varies with the sizes used. Thin files are held under tension like saw blades, while larger profile types are held under pressure and are fastened in ring-shaped holders which enable them to be quickly replaced. Files from 4 to 8 inches long can be used on the small- and medium-sized machines, and from 6 to 10 inches long on the large machine.

Saws of two distinct types are employed, namely, short-length straight saws and saws 7 feet long which are rolled into coils. The short-length saws are held in the same holder as the files, while the coiled saws are held in magazines furnished with the machine, and drawn out as required. When the teeth of the coiled saws become worn, the used portion is merely broken off and a new portion is withdrawn from the coil.

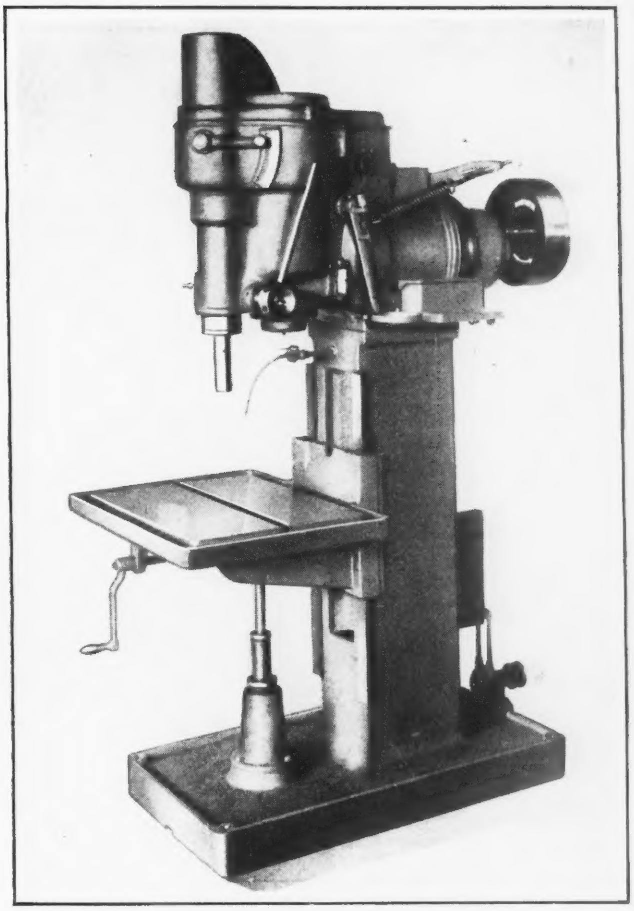
The table is easily raised and lowered to suit the



Battery of Lakeside Drilling, Reaming, and Countersinking Machines Installed in a Structural Shop



Die Filing and Sawing Machine Placed on the Market by Marburg Bros., Inc.



Gaterman Pneumatic Tapping Machine with Improved Spindle Return

work, and it can be tilted up to 15 degrees in four directions to permit filing or sawing at an angle in any direction and finishing corners. Adjustable devices are furnished to hold the work on the table while it is being moved in accordance with pressure exerted either by means of the automatic feeding device or by hand.

The stroke of the machines can be quickly adjusted to suit the thickness of the work blank and the length of files and saws being used. With the exception of the smallest size, the machines are equipped with both hand and automatic feeding devices. The automatic feed arrangement is such that the work may be under the influence of this feeding device either during the entire operation or during down strokes only. An advantage of this feature is that heavy saws can clear themselves on the up stroke.

Chips produced in filing or sawing operations are blown away by air so as to keep the markings on work blanks visible, compressed air being furnished by a small pump. A mirror fastened to the machine permits the observation of cuts taken on internal surfaces.

GATERMAN HEAVY-DUTY PNEUMATIC TAPPING MACHINE

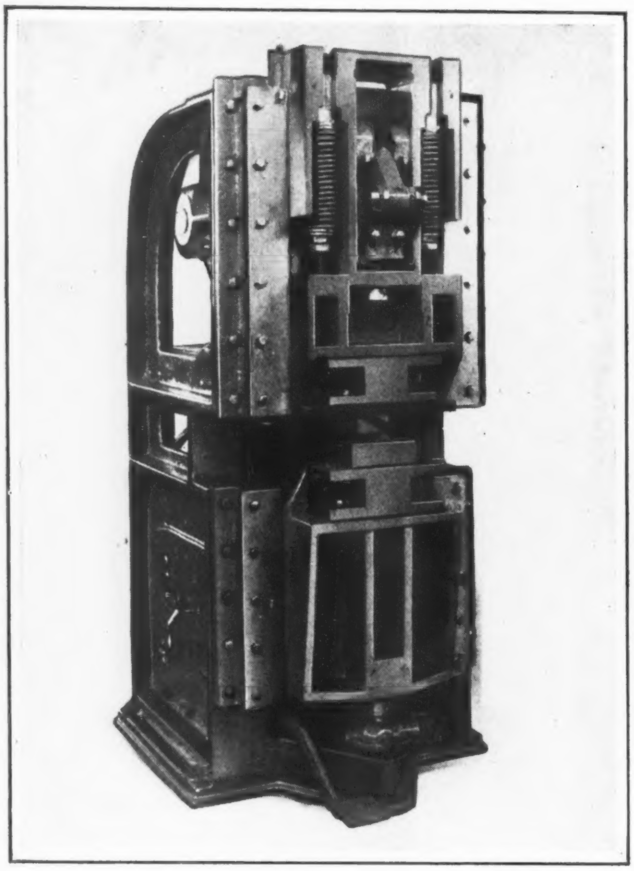
A No. 5 heavy-duty pneumatic oscillating tapping machine has just been added to the line of machines of this type built by the W. Gaterman Mfg. Co., Franklin and 15th Sts., Manitowoc, Wis. This new machine is furnished in two ratios of drive from the clutch spindle to the tap spindle. With one ratio, the machine has a capacity for tapping from 1/8- to 1/2-inch holes with U. S. standard threads in steel at spindle speeds ranging from 425 to 1000 revolutions per minute. With the other ratio, holes from 1/4 to 3/4 inch can be tapped with U. S. standard threads at spindle speeds ranging from 212 to 500 revolutions per minute.

The machine follows closely the design of the larger No. 10 heavy-duty tapping machine. However, an improvement has been made in the method of returning the spindle, so that a wide range of adjustable return torque is available to suit variations in the size of multiple heads which may be applied to the machine. This improvement has also been incorporated in the No. 10 tapper.

These tapping machines are so designed that when the torque or load on the tap is more than a dial-set predetermined resistance, the spindle will automatically back up slightly to allow the tap to free itself, and will then advance again for performing the work. The new No. 5 machine taps to a maximum depth of 5 inches. The distance from the center of the spindle to the column is 10 inches, the vertical adjustment of the table is 18 inches, and the net weight of the machine is 1000 pounds.

TAYLOR-WINFIELD PROJECTION WELDERS

Projection welding machines in three styles, known as types C, HD, and E, are being introduced on the market by the Taylor-Winfield Corporation, Warren, Ohio. These machines can be used for



Taylor-Winfield Projection Welding Machine

projection welding of all kinds, and may also be employed as ordinary spot welders. They are particularly adapted for the multiple welding of wire racks or similar articles. The type C machine is shown in the illustration.

In the operation of these machines, a steady spring pressure is exerted on the work. This pressure is gradually increased through a toggle and cam action. The electric current is automatically turned on during the time of pressure, heating the projections on the work to the welding temperature. All three types of these projection welders have water-cooled transformers.

"CAMITE"—A HIGH-SPEED CUTTING ALLOY

The Cleveland Automatic Machine Co., 2269 E. 65th St., Cleveland, Ohio, is placing on the market a high-speed cutting alloy having a hardness little less than that of the diamond. This alloy is known as "Camite." Credit for its development is given to Emanuel Lavagnino, an American chemist with Italian metallurgical training.

Among the principal advantages claimed for the new alloy is the capacity for taking cuts at unusually high speeds and at two or three times the customary depth without detriment to the tool. Intermittent cuts can be taken under severe conditions. While suitable for finish cuts, "Camite" is said to be particularly adapted for use in roughing operations, especially in taking roughing cuts on hard materials or those having an abrasive action. Deep cuts have been taken at high speeds on castings having an exterior with a high silicon content, and on hard steels, brass, bronze, and aluminum.

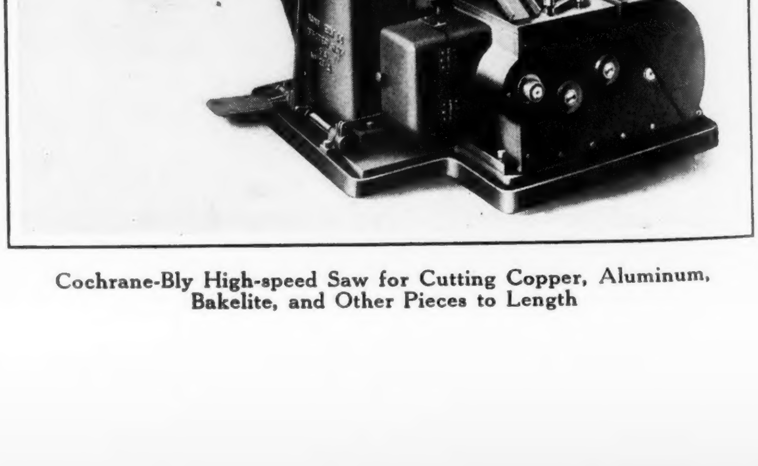
The alloy is regularly furnished in definite stock sizes for brazing to suitable shanks or tool-holders. The alloy portions are then ground to a cutting edge, directions being given by the company for the brazing and grinding operations. Special sizes and shapes are made to order.

COCHRANE-BLY AUTOMATIC HIGH-SPEED CUT-OFF SAW

A new high-speed cut-off saw designed for automatically cutting to length brass, copper, and aluminum bars and tubing, hard rubber, bakelite, and wood strip, has just been placed on the market by the Cochrane-Bly Co., Rochester, N. Y. Among the features of this machine are an automatic power stock feed and an automatic clamping vise and trip. The machine has a capacity for cutting a 2-inch copper bar, a 3-inch brass bar, a 4-inch brass or copper tube, as well as flat bars and extruded shapes.

The movement of the saw carriage is adjustable from 1/2 to 4 1/4 inches, and speeds varying from 5 to 50 strokes per minute are obtainable with standard gearing. Provision is made for much faster operation on small special work. The saw carriage is mounted on dovetailed ways, and is provided with an adjustable taper gib to compensate for wear.

The spindle is heat-treated and is mounted in dustproof Timken tapered roller bearings. The drive from the motor is positive by means of a silent chain, provided with an idler sprocket which absorbs slack chain and compensates for variation between centers due to the carriage movements. A constant-, variable- or multiple-speed motor can be used to obtain desirable cutting speeds for the various materials handled.



Cochrane-Bly High-speed Saw for Cutting Copper, Aluminum, Bakelite, and Other Pieces to Length

THOMSON ELECTRIC WELDING MACHINES

Two new welding machines have recently been developed by the Thomson Electric Welding Co., Lynn, Mass. One of these machines, shown in Fig. 1, is a power-driven butt-welder intended especially for making T-welds or welds at an angle, which might be termed "miter" welds. This machine is particularly suitable for shops manufacturing window sash, but different types of clamps may be supplied for different classes of work. Clamps may be provided for handling flat strip stock not over 4 inches wide and for round or tubular members having a cross-section not exceeding 1/2 square inch. The clamps are air-operated and controlled by foot-operated valves. They are arranged to operate in unison or independently.

The moving platen is mounted on round side-rods sliding in bearings at the right- and left-hand ends of the frame. The return of the platen to the open or loading position may be done either by hand or automatically. The welding speed may be varied from 10 to 20 cycles per minute.

The welder is motor-driven. The transformer is of 60 kilovolt-amperes rating and completely protected from flash, as are also the bearings for the side-rods of the platen. The net weight of the machine is from 3000 to 3500 pounds, depending on the type of clamps used.

The machine shown in Fig. 2 is known as the model 502 cowl welder. This machine is built from heavy steel castings and structural plate and shapes. It has four clamping cylinders operated from a single Oilgear pump. In addition to these four vertical cylinders, there are four small horizontal cylinders for clamping the vertical flanges on the outer edges of the cowls.

The "push-up" pressure and movement is obtained through a direct motor-driven cam having a cycle of 7 seconds. Because of the width of the machine, two identical cams mounted on the same shaft are used for the push-up movement. The return of the movable platen to the open or loading position is effected by two air cylinders. The speed reduction between the motor and the camshaft is obtained through a "Texrope" drive and a gear reduction unit. The transformer is rated at 250 kilovolt-amperes. The net weight of the machine is approximately 30,000 pounds.

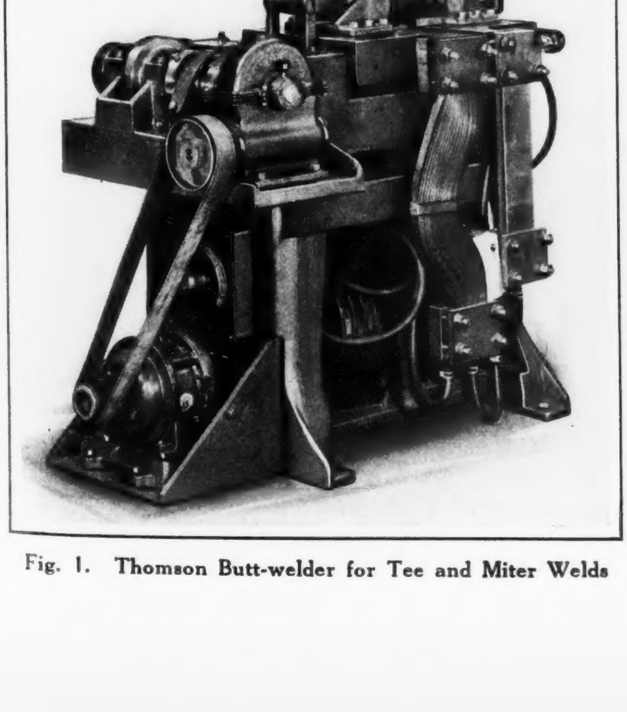


Fig. 1. Thomson Butt-welder for Tee and Miter Welds

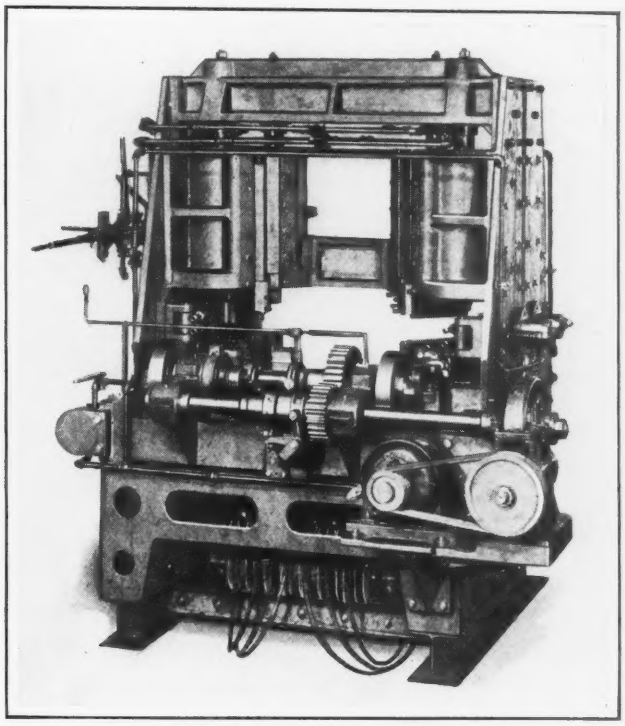


Fig. 2. Thomson Automobile Cowl Welder

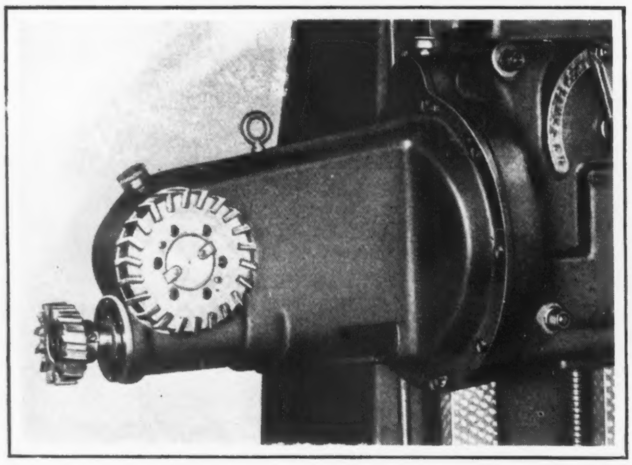
A machine of this design can be adapted to various shapes of cowls, and with minor changes is also suitable for butt-welding wide thin sheets up to approximately 44 inches in width.

GIDDINGS & LEWIS COMBINATION SIDE AND END MILLING HEAD

The Nos. 45 and 50 horizontal boring, drilling, and milling machines built by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., may now be equipped with the combination side and end milling head here illustrated. This attachment is particularly suitable for such operations as milling the slide ways and bolster plate surfaces of punch press frames. It forms a complete unit, which is bolted and doweled directly to the head of the machine in place of the back-gear cover plate, and it can be readily attached or removed. An eye-bolt facilitates handling by means of a hoist.

Power for driving the milling cutters is taken from the machine spindle. A spur gear with a Morse taper arbor is placed in the spindle and the spindle is extended to make the gear mesh with a gear on the end of the worm-shaft to which the small milling cutter is attached. The large milling cutter is driven from the small cutter shaft through worm-gearing. The speed of the large cutter is one-quarter that of the small cutter, and the speed of the latter is the same as the spindle speed of the machine.

Heavy type combination radial and thrust ball bearings are furnished in the attachment, and these, together with the worm, etc., are packed in grease and completely enclosed. A bolt, accessible through the hand-hole, is used for drawing the small milling cutter arbor into the socket.



Milling Head for Gidding & Lewis Horizontal Boring, Drilling, and Milling Machines

This milling head can be furnished in two sizes with single or double side milling cutters. On the small size, the large cutter is 10 inches in diameter and the small cutter is 5 inches in diameter, while the reach is 27 inches; whereas on the large size, the large cutter is 12 inches in diameter, the small cutter is 6 inches in diameter, and the reach is 32 inches. A similar attachment can be furnished with the large cutter arranged for vertical milling.

"BELTSLACKER" DRIVES

Two new applications of "Beltslacker" drives which are designed to automatically take up belt stretch or let out belting to compensate for shrinkage, have recently been made by Harry M. Perry, 638 N. Main St., Los Angeles, Cal. An idler pulley which keeps the tension of the belt uniform, regardless of stretch or shrinkage caused by changes in the load and temperature, is employed to obtain the desired results.

The phantom view, Fig. 1, shows the method of applying a standard gravity-type "Beltslacker" directly to the housing of a motor. In this type, the weight of the pulley serves to maintain the required tension of the belt. In the case of the application shown in Fig. 2, a cantilever spring is employed to keep the belt under the proper tension.

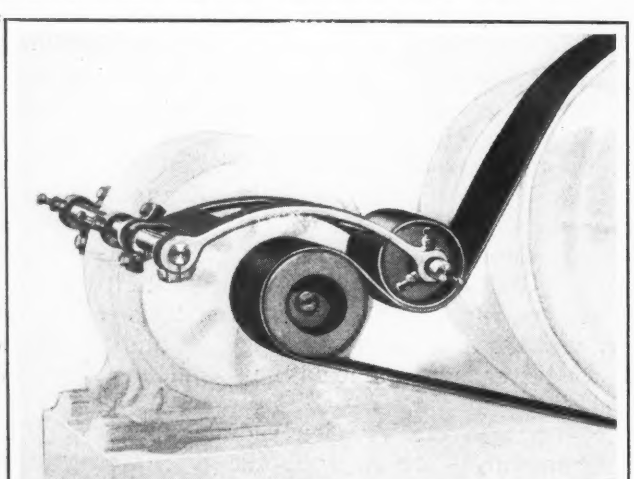


Fig. 1. Method of Applying "Beltslacker" to Motor Housing

The spring is clamped to a split sleeve which can be rotated on the hinge bar and clamped in any desired position. Two or more springs of this type can be used in drives transmitting greater power.

Another recent application of the "Beltslacker" drive has proved effective for gas-engine drives which are subjected to irregular belt action. In this drive, a light-weight Timken-bearing idler pulley is used to keep the inertia and momentum factors at a minimum. An adjustable spring tension device maintains constant belt contact and eliminates destructive pounding action. In some installations of this kind, a heavy idler pulley can be used so that no tension springs are required.

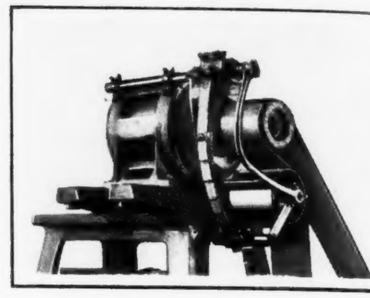
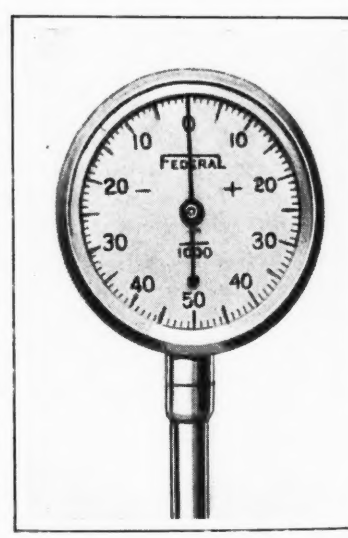


Fig. 2. "Beltslacker" Drive Equipped with Cantilever Spring

FEDERAL DIAL INDICATOR

A model "80 Junior" dial indicator, recently brought out by the Federal Products Corporation, Providence, R. I., is identical to the model 80 indicator made for several years, but is much smaller in diameter. The diameter of the case is 1 23/32 inches. The holding bar is regularly 2 3/8 inches long by 1/4 inch in diameter, but special sizes of holding bars can be furnished to meet requirements.

This gage can be supplied either with or without a jewel bearing movement. The racks are chromium-plated, and the movement is a separate unit to insure alignment. The stem is cast integral with the case to eliminate the necessity of using any solder. For cleaning or repairing, the entire movement can be removed from the case in less than two minutes. The range of the indicator is 0.200 inch, and dials can be provided graduated either from 0 to 50 to 0 or from 0 to 100.

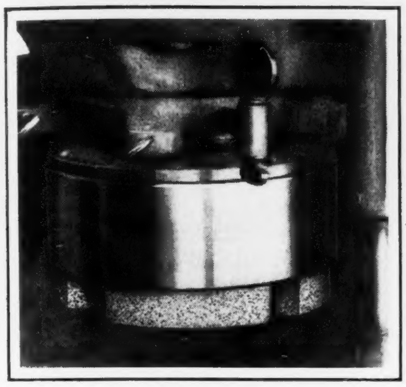


Federal Indicator with Small-diameter Case

BLANCHARD SEGMENT GRINDING WHEEL

The Blanchard Machine Co., 64 State St., Cambridge, Mass., has brought out an 11-inch segment wheel for use on the company's No. 10 surface grinding machine. The segment wheel consists of a chuck body machined from a solid steel forging, four abrasive segments with rounded ends, two fixed partitions or abutments secured in the chuck body, and two clamping units consisting of shoes

fitting the ends of the segments and expanded by a wedge and screw. The clamping units force the segments against the fixed abutments and also, outward, against the outer shell of the chuck body. There are only two screws to loosen or tighten when adjusting or changing the segments. The latter are 5 inches deep when new, and of this length 4 inches can be used.

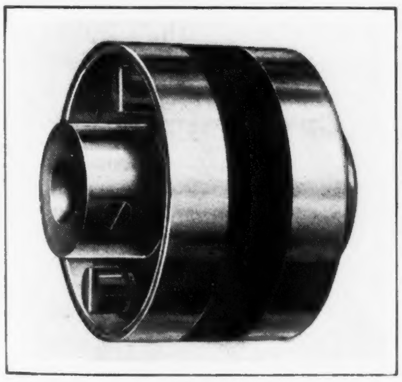


Blanchard Segment Wheel for Surface Grinders

The entire segment wheel is mounted on the faceplate of the machine in the same manner as a standard ring whel, and can be easily removed. No change is necessary in the machine when using this segment wheel, the advantages of which are that it saves abrasive costs, especially on work of medium-sized or broad surfaces; and that it cuts faster and cooler on broad surfaces. The body of the chuck is cadmium-plated to resist rust, while the other parts are made of aluminum bronze, except the screw, which is made of stainless steel.

AJAX FLEXIBLE COUPLING

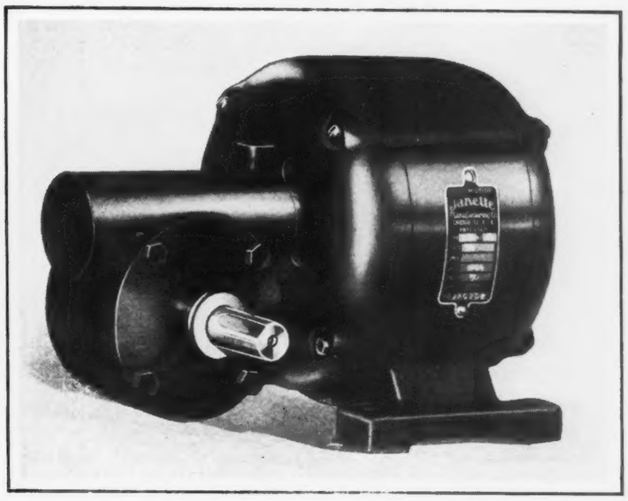
A light-duty inexpensive flexible coupling, primarily intended for manufacturers of machinery who use a large number of small couplings and whose equipment only requires an inexpensive connecting unit, has been brought out by the Ajax Flexible Coupling Co., 894 Welch Bldg., Westfield, N. Y. The coupling, known as type C, is made of two die-cast flanges with wide faces machined true with the bore. These two flanges are connected by means of four setscrews, two in each flange, which are screwed through the flanges and into four nuts. These nuts are permanently molded into a rubber center piece, which acts as a shock absorbing medium. The coupling is made with bores from 1/2 to 1 1/4 inches in diameter. It is so designed as to correct slight misalignment and absorb the shocks in starting and stopping machinery.



Ajax Flexible Coupling

JANETTE MOTOR-DRIVEN SPEED REDUCER

The Janette Mfg. Co., 556-558 W. Monroe St., Chicago, Ill., has recently brought out a speed reducer consisting of a worm-gear unit enclosed in a cast-iron housing which is bolted direct to the frame of a driving motor. The flange of the gear casting forms the end frame of the motor. This unit is available with motors ranging in capacity from 1/30 to 1/4 horsepower and with speed reduction ratios ranging from 20 to 1 up to 50 to 1. With a motor speed of 1750 revolutions per minute, countershaft speeds of from 35 to 87.5 revolutions per minute are obtainable, and with a motor speed of 1150 revolutions per minute, countershaft speeds of from 23 to 57.5 revolutions per minute can be obtained.

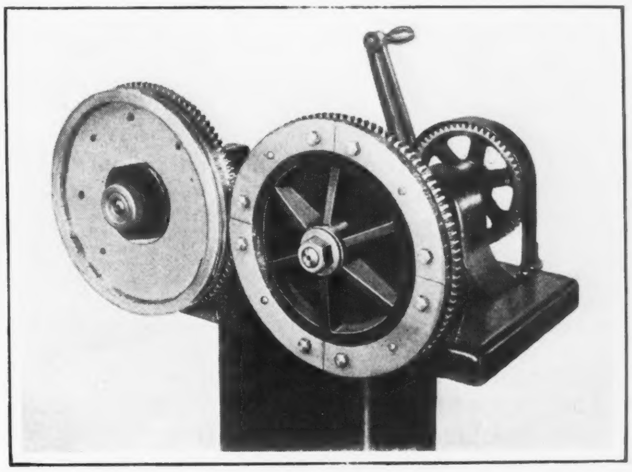


Janette Speed Reducer with Direct-connected Motor

The worm is made of hardened steel and the gear of bakelite. The gear housing is oil-tight and is filled with oil before leaving the factory. No further lubricant is required during the life of the unit, except for the front motor bearing, which requires occasional greasing. Fafnir ball bearings are provided for the motor. A standard Janette motor for either direct current or split-phase or repulsion-induction alternating current is supplied.

NOBLE & WESTBROOK ROTARY GRADUATING MACHINE

Aluminum disks 12 1/4 inches in diameter are graduated into 400 divisions with numbers at every five division lines, in a special machine here shown, which is a recent development of the Noble & West-



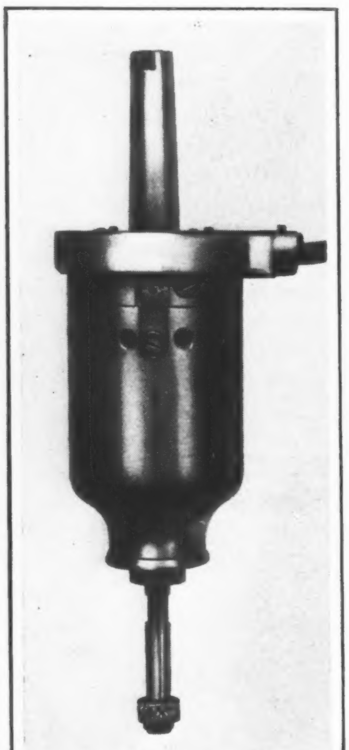
Noble & Westbrook Graduating Machine for Aluminum Disks

brook Mfg. Co., Hartford, Conn. The numbers and graduated lines are rolled on the disks in one operation by steel marking dies.

The marking dies are made in sections, and these sections are removable. They are mounted on the large carrying wheel at the right, while the disk to be graduated and numbered is attached to the other large gear. The required pressure for rolling the graduations and numbers on the work is supplied through a foot-treadle and a lever within the column. The machine is operated by means of a hand-crank.

OLOFSON PRECISION GRINDER

A precision grinder having a tapered shank to permit mounting on the spindle of any standard machine tool, such as vertical or horizontal boring, milling or drilling machines, has recently been placed on the market by the Progressive Tool Co., 429 N. Le Roy St., Fenton, Mich. By employing a special adapter in combination with a holder designed for insertion in a toolpost, the grinder can be used for internal grinding in a lathe.



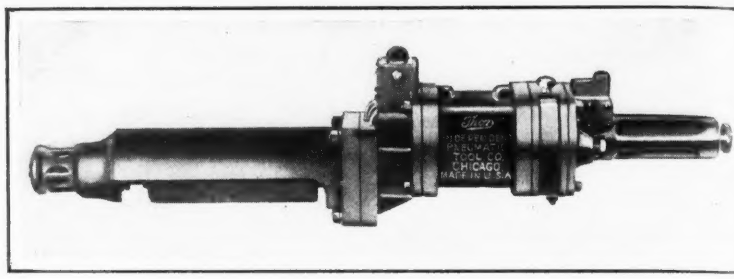
Olofson Grinder Designed for Mounting on Machine Tool Spindles

The motor of this grinder is of the universal type which operates on either alternating or direct current. The spindle of the motor is mounted in ball bearings and has a speed of 10,000 revolutions per minute. The motor case itself turns at the same speed as the machine spindle in which the grinder is used. The spindle quill runs true within a high degree of accuracy and can be removed.

By means of a graduated dial, an offset adjustment of the spindle is obtainable to make the grinding wheel travel along an eccentric path. This adjustment allows for a 1-inch variation on the diameter. A large range of hole diameters can be ground when several sizes of wheels are on hand.

THOR LOCOMOTIVE-ROD GRINDER

A portable grinder especially adapted for finishing locomotive parts has been placed on the market by the Independent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill. This grinder is intended for surfacing locomotive frame-jaws, rods, straps, rod brasses, shoes, wedges, welds, and valve motion parts. The wheel guard is made small enough in diameter to pass into a 2 3/4-inch space. The grinder is available in two lengths of wheel —6 and 9 inches. In both cases, the wheels are 2 1/2 inches in diameter and run at 7000 revolutions per minute. The 6-inch grinder is 26 inches long and weighs 21 1/2 pounds, while the 9-inch grinder is 29 inches long and weighs 23 3/4 pounds.



Thor Portable Grinder for Locomotive Work

EXCELSIOR BALL-BEARING LEVER PUNCH

Holes up to 5/16 inch in diameter can be punched through 5/16-inch sheet iron, and holes up to 1/2 inch diameter through brass or copper sheets, by means of a No. 19 lever punch built by the Excelsior Tool & Machine Co., East St. Louis, Ill. One of the important features of this equipment is the provision of ball bearings on the eccentric and main shaft, which provide for easy operation. The stand is equipped with legs that protrude forward, so that the machine cannot tip when punching to its capacity. Two wheels, attached to the back of the stand, permit the machine to be readily moved.

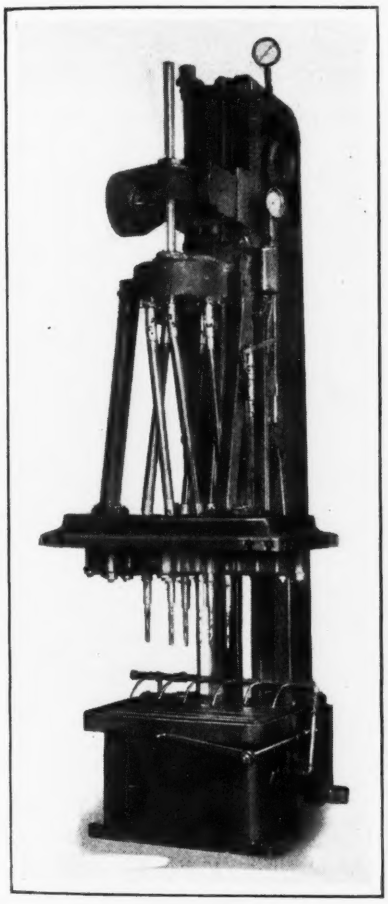
The operating handle is balanced, so that it always assumes an upright position. A stripper is provided which does not obstruct the view of the punch, and there are gages both at the front and side, which are adjustable to suit requirements. Punch shanks 7/16 or 7/8 inch in size can be used.

Excelsior Ball-bearing Lever-operated Punch

MOLINE HYDRAULIC-FEED DRILL

Among the outstanding features of a multiple-spindle drilling machine recently added to the line manufactured by the Moline Tool Co., Moline, Ill., are the Oilgear unit which can be set to give any feed within the capacity of the drills, "Texrope" drive, V-guides for the slide and column, "one-shot" lubricating system, and patented vertical adjustment of the spindles to compensate for wear of the drills. The working cycle is automatic and is controlled by a lever at the front of the machine.

The upper part of the column is cored out to receive the motor. The latter can be adjusted for tightening the "Texrope" belts which drive the speed mechanism and Oilgear pump. The drive is through spiral gears to the main vertical drive shaft and then through spur gears to individual drivers in the circular head, from which power is transmitted to the lower drilling spindles through universal joints.



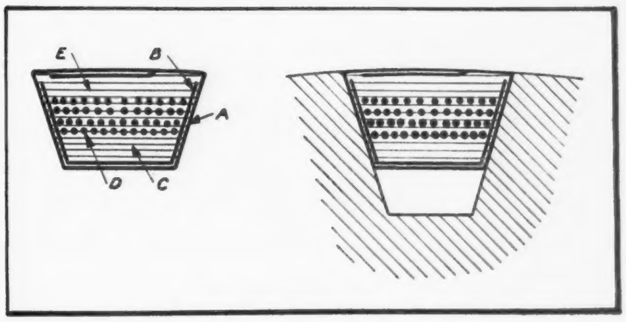
Moline Multiple-spindle Drilling Machine with Hydraulic Feed

The machine is equipped with a driving unit for twelve spindles, although only six spindles are installed on the machine shown. The spindles may be adjusted within a rectangle measuring 12 by 30 inches. Long shafts between the universal joints reduce angularity to a minimum and thus insure long life of the joints. This construction also permits the use of long slide bearings on the column.

The machine has a capacity for driving twelve 11/16-inch drills in mild steel. The minimum center adjustment of the spindles is 2 1/8 inches. The minimum distance from the spindle noses to the table is 4 inches and the maximum distance, 28 inches. The machine weighs 11,500 pounds.

"FLEX-MOR" V-BELT DRIVES

Multiple V-belt drives known by the trade name of "Flex-Mor" are being introduced on the market by Fairbanks, Morse & Co., 9 and Wabash Ave., Chicago, Ill., for all kinds of power transmission service. The V-belts used in these drives are built up of an outer belt jacket of duck which has been treated with rubber to improve its wearing qualities. Two layers of duck, *A* and *B*, enclose a rubber core *C*, several layers of rubber embedded cords *D*, and another rubber layer *E*.



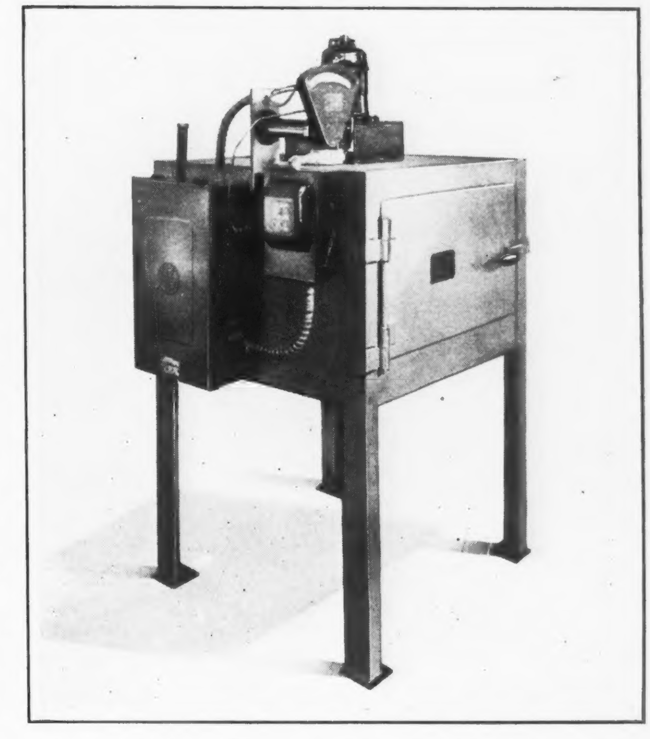
Diagrams Showing Features of V-belts Used in "Flex-Mor" Drives

The layer of rubber below the cords is compounded to withstand repeated compression, while the rubber layer above the cords is compounded to withstand repeated tension. The rubber embedded cords are at the neutral axis of the belt, where there is the least tension or compression. These cords are made of long staple cotton, and the construction is similar to that used in cord tires. The various elements of the belt are assembled into a mold and vulcanized into a unified structure.

Semi-steel sheaves are used, which have been designed with particular reference to the angle and depth of the grooves, so that belt slippage will be kept at a minimum. At the same time, the relation between the angles of the belt sides and the grooves is such that the belt makes a gradual contact with the grooves as it bends around the sheaves. Owing to the wedging action of the belts in the grooves and to their inherent elastic qualities, there is no sudden grabbing of the load.

GENERAL ELECTRIC AIR-TEMPERING OVEN

A type AD oven for drawing carbon steel has been placed on the market by the General Electric



General Electric Tempering Oven with Motor-driven Fan

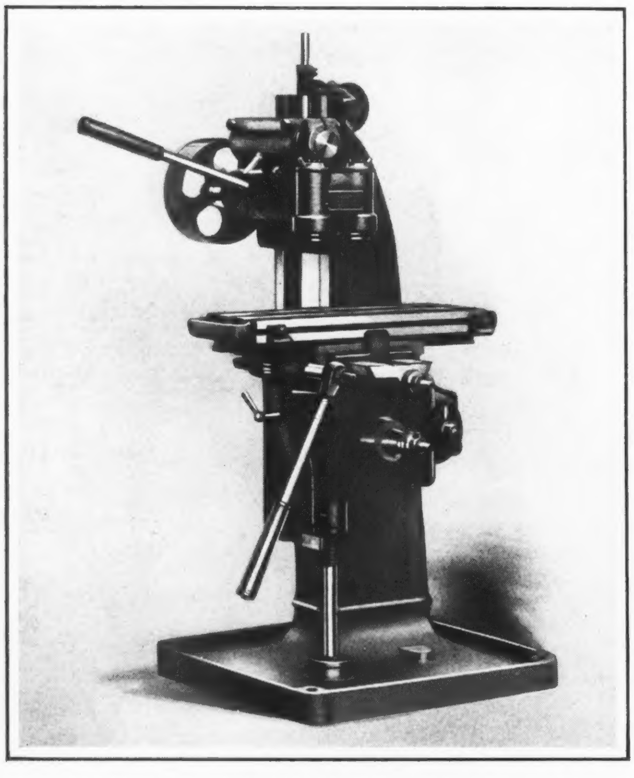
Co., Schenectady, N. Y. One of the features of this oven is the use of a fan for agitating the air around the work, with a view to improving the quality and increasing production. The fan is located in the heating chamber, and is driven by a vertical motor mounted on top of the oven. It is claimed that, with the fan, much less time is needed to heat a given charge than is required with a still-air type of oven. Any temperature up to 750 degrees F. can be obtained, the oven thus covering the full range of temperatures required for drawing and bluing carbon steel.

The oven is of double-wall construction throughout, with an intervening space of 4 inches filled with heat-insulating material. The steel sheets that form the walls are electrically welded together and reinforced by angle-irons welded along the corners and extended downward to form the legs. A strip steel grate supports the work.

One sheath-wire heating unit is located at the top of the heating chamber, and a second just under the hearth. Both windings are so distributed as to give uniform heating over the entire hearth. Temperature control is fully automatic. The width of the oven chamber is 24 inches; the depth, 21 inches; and the height, 9 inches.

HAND MILLING MACHINE WITH TWO-SPINDLE VERTICAL ATTACHMENT

Hand milling machines built by the Superior Machine & Engineering Co., 1930 Ferry Park, Detroit, Mich., may now be equipped with a two-spindle vertical milling attachment as illustrated. This double-spindle attachment is carried on the main spindle head of the machine. Both vertical spindles are mounted in Timken tapered roller bearings, and they are provided with spring chucks and draw-in bolts so that straight-shank end-mills can be used.

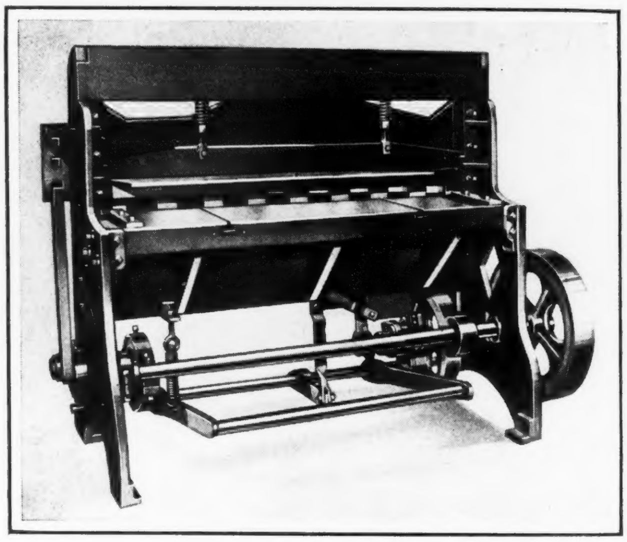


Double Vertical-spindle Hand Milling Machine Built by the Superior Machine & Engineering Co.

The main spindle head has a vertical travel of 4 1/2 inches on the column, effected by a hand-lever. A long narrow way guides the main spindle head close to the cutter and a taper gib permits of readily taking up wear. A longitudinal travel of 6 inches may be obtained by operating the table lever. The table has a transverse movement of 6 inches and a vertical movement of 12 inches. Either a belt or motor drive can be furnished. The machine weighs approximately 1000 pounds.

DREIS & KRUMP LIGHT-TYPE UNDER-DRIVE SHEAR

Heavy type under-drive squaring shears, added to the line of all-steel metal-working machinery built by the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill., were described in April MACHINERY, page 630. This concern has now developed the lighter type of under-drive shear here illustrated. The new machine differs from the heavier shears in regard to the driving mechanism, there being a two-shaft drive with a positive quick-acting jaw clutch instead of a three-shaft drive with a friction clutch.



Dreis & Krump All-steel Shear for Light-gage Sheet Metal

When the treadle is fully depressed, the upper knife bar makes one complete stroke and stops at the highest point, except when the treadle is kept depressed, in which case the bar operates continuously. Unless it is desired to have the upper knife bar in continuous operation, it is not necessary to keep the treadle depressed while the shearing is being performed. The clutch jaws are faced with tool steel to insure long wear.

This machine is primarily designed for use in shops where speed is essential in cutting metal sheets of the lighter gages. The steel-plate welded construction is a feature and Timken tapered roller bearings are provided for the flywheel shaft. As on the heavier shears, the hold-down insures a uniform pressure on the metal before a cutting operation is started, and maintains this pressure to the end of the stroke. The system of lubrication is the same as on the heavier machines.

KING PUNCHES AND PUNCH RETAINERS

A complete line of interchangeable punches and punch retainers, embodying improved features which can be incorporated in any piercing die, has recently been developed by the King Works, 7350 St. Aubin St., Detroit, Mich. The retainers are employed as shown in Fig. 2, and can be used singly or in gangs. They permit a broken punch to be quickly removed and replaced by a new one without removing the die from the press. Simply raising the locking wedge against the tension of the spring permits the punch to drop out.

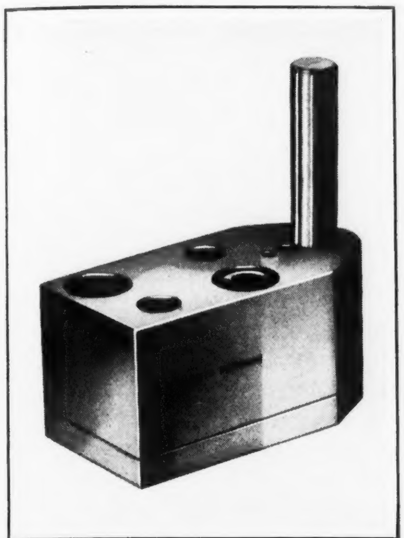


Fig. 1. King Retainer Block for Punches

The punches and punch retainers are made in all sizes, the punches in all shapes, and the retainers in three different shapes which lend themselves to every conceivable lay-out or grouping of the holes. It is a simple matter to line up a punch with the corresponding die hole, as the punch can be easily moved up or down before being locked in position by the wedge. Fig. 1 shows a retainer block with one punch in place.

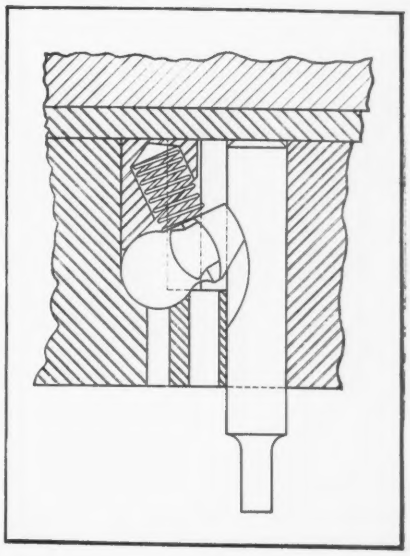


Fig. 2. Sectional View Showing how the King Punch Retainer Functions

ENGINEERING CONGRESS IN JAPAN

This fall Japan will stage an unusual event in the engineering field. A World Engineering Congress will open October 29 in Tokio. Every branch of engineering will be represented, and the elaborate program includes not only the presentation and discussion of papers pertaining to almost every field of industry, but also visits to Japanese factories.

The Congress is sponsored by the Japanese Government, and it is expected that passes on all Japanese railroads and steamship lines will be provided for the foreign delegates. The Federated Engineering Societies of Japan, representing seventeen different engineering societies, will be the hosts of the visiting engineers on an extensive journey to the principal industrial centers in Japan, Korea, and southern Manchuria. It is not generally known in this country that the Japanese engineering societies have very large memberships, the one representing mechanical engineering having 30,000 members.

It may also be news to many to know that a tremendous amount of engineering research is going on in Japan, and that many new discoveries, especially in highly scientific applications to industry, have come from that country. There are now in Japanese basic industries ninety-three research laboratories manned with a high-class personnel and provided with the most modern equipment.

The American delegation will sail from San Francisco on the SS. *President Harding,* October 11. The tour planned will occupy about two months, and the cost will be approximately $1500 per person. Many delegates from European countries will join the American delegation at San Francisco, and the steamer will be reserved entirely for the party bound for the Congress. Those wishing to obtain further information should address Maurice Holland, executive secretary of the American Committee, World Engineering Congress, 29 W. 39th St., New York City.

MEETING OF THE WELDING SOCIETY

The annual meeting of the American Welding Society was held April 24 to 26 in the Engineering Societies Building, 29 W. 39th St., New York City. Among the papers read were the following: "Physical Properties of Butt Welds," by G. Lobo, Westinghouse Electric & Mfg. Co.; "Design of Joints for Welded Steel Structures," by A. Vogel, General Electric Co.; "Welding in the Heating and Ventilating Industries," by Professor S. E. Dibble, Carnegie Institute of Technology; "Welding in the Aircraft Industry," by R. M. Mock, Bellanca Aircraft Corporation; "Thermit Welding of Rail Joints for Main Line Track of Steam Railroads," by J. H. Deppeler, Metal & Thermit Corporation; "Welding Aluminum in the Chemical Industry," by W. M. Dunlap, Aluminum Company of America; "The Production of Ductile Welds in Nickel and Monel Metal," by N. B. Pilling, International Nickel Co.; "Welding in the Gas-handling Industry and Requirements of Welding in the Chemical Field," by R. S. McBride, assistant editor, *Chemical and Metallurgical Engineering;* "Welding of Pressure Vessels for High Temperature and Pressures," by T. McLean Jasper, A. O. Smith Corporation. A symposium was also held on "How to Organize and Operate an Industrial Welding School."

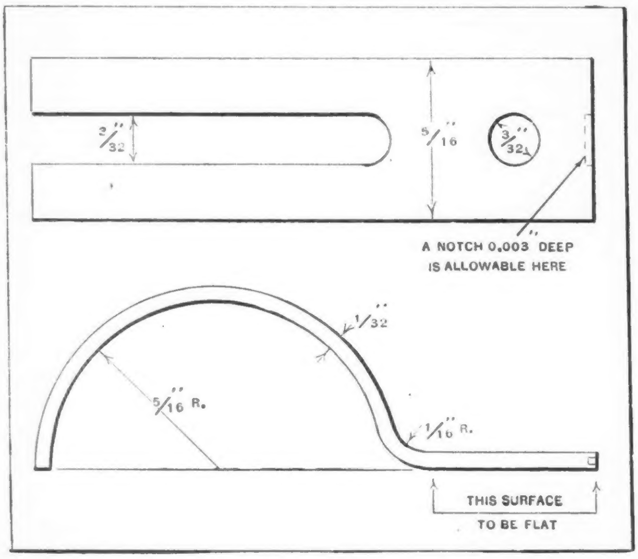
* * *

The exports of industrial machinery during February, the last month for which complete statistics are available, continued their upward trend. The total value for the month was $19,562,000, an increase of 30 per cent over the corresponding month of 1928. Of this total, metal-working machinery amounted to $3,140,000, as compared with $2,373,000 during the same month a year ago. In the metal machinery group, exports of gear-cutting machines amounted to $108,000, and internal grinding machines to $132,000.

Questions and Answers

BENDING STEEL CLIPS BY ROLLING

S. B.—In the accompanying illustration is shown a clip made from non-tempered, hard-drawn flat steel stock, 1/32 inch thick. The production requirement on these clips is about 1,000,000 per month. It has been suggested that they might be profitably made by a rolling process, but some doubt is expressed as to the feasibility of such a method. The problem of applying the rolling process to the production of the steel clips is submitted to the readers of MACHINERY, and concise suggestions are solicited.



Clip to be Produced from Hard-drawn Steel Stock

CANCELLING AN ORDER THAT HAS NOT BEEN ACKNOWLEDGED

B. D. Z.—On May 3, I placed an order with a salesman for a machine to be delivered on or before July 15. The manufacturer did not acknowledge my order. On May 20, I wrote the maker cancelling the order. He answered my letter stating that the cancellation would not be accepted, and proceeded to ship the machine on June 15. I refused to take the machine from the railroad and the manufacturer states that he will sue me if I do not accept delivery. What are my legal rights in this matter?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

You had a legal right to cancel this order any time before the instant the seller mailed a letter acknowledging your order. The latest case on this subject is 211 N.W. 230. The question presented to the Court was whether a buyer may cancel an order before it has been accepted in writing by the seller. The buyer signed an order to have shipped by express, as soon as possible, certain material. The order was given to a salesman and forwarded by him to the seller. The seller received the order on June 14, and proceeded to prepare the goods especially for the shipment, *but did not write the buyer.* On June 16, the buyer wired cancellation, and on June 19, wrote a letter of cancellation. On June 20, the seller wrote a letter acknowledging receipt of the telegram, but refused to accept the cancellation and proceeded to ship the merchandise. The buyer refused to accept the shipment and the seller sued the buyer.

The Court held the buyer not liable and explained that a buyer may cancel an order given to a salesman, without liability, any time before the seller acknowledges receipt of the same. This is true because a valid contract does not exist until the seller accepts the order given to the salesman.

MAKING FLAT WASHERS IN QUANTITY

W. B.—What is the most economical way to produce flat washers in quantity? In a progressive die, there is a tendency for the washers to become cup shaped; how are they kept flat? In using a compound die, if more than three are made at one time, I have had difficulty with the washers dropping back on the die; also, the dies clog up because the washers stick to the top part. Would readers of MACHINERY suggest means for overcoming these difficulties?

Answered by E. A. Sisson, New Castle, Ind.

In most cases, the compound die is preferable to use. To prevent the work from sticking to the punch, place a small spring pin in the punch near one edge, allowing the end of the pin to extend about 1/16 inch from the face of the punch. This will eject the washers. The remaining difficulty mentioned may be overcome by using an inclined press.

* * *

DETERMINING COLOR BY NEW INSTRUMENT

The exact duplication of any color at any time and at any place has been made possible by a new colorimeter developed by Professor Arthur C. Hardy of the department of physics at the Massachusetts Institute of Technology, which was described by him at the annual convention of the Optical Society of America, at Washington on November 1. Should a new color be developed by fashion dictators at Paris, for instance, a photo-radiogram of the color analysis can be sent to New York, and there duplicated by dye experts, even though these men are not able to see an actual sample of the original color for some days. The new color analyzer, known as a "recording spectrophotometer," eliminates human judgment entirely, and automatically measures the color and wave lengths of any substance rapidly and with precision. Not only does it measure color accurately, but it makes a record by which it is possible to match that shade at any time, thus eliminating all possibility of fading of a standard color.

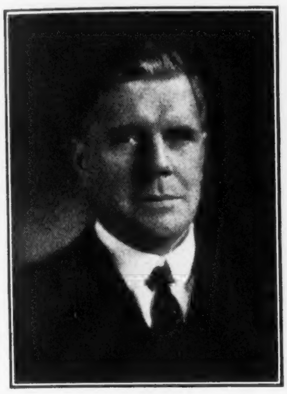
PERSONALS

OGDEN R. ADAMS has opened a new office at 407 Cutler Bldg., Rochester, N. Y., for the sale of machine tools.

FRED ERB, president of the Erb-Joyce Foundry Co., Detroit, Mich., has been elected president of the American Foundrymen's Association.

M. W. ELMENDORF, formerly associated with the Pfaudler Co., Rochester, N. Y., has entered the Engineering Division of the Taylor Instrument Companies, Rochester, N. Y.

E. C. ANDERSON has joined the sales force of the Modern Tool Division of the Consolidated Machine Tool Corporation of America, at Chicago, Ill. Mr. Anderson was formerly connected with the Stocker-Rumely-Wachs Co., of Chicago.



J. C. Lincoln,
Chairman Board of Directors
Lincoln Electric Co.

J. C. LINCOLN, formerly president of the Lincoln Electric Co., Cleveland, Ohio, has been made chairman of the Board of Directors. J. F. LINCOLN, formerly vice-president, and since 1912 general manager of the company, has been promoted to the presidency. J. C. Lincoln's new duties will afford him additional time to devote to electrical research and experimental development work, which has been his major interest for several years.

K. A. FERGUSON has joined the sales organization of the Cam Blades Machinery Co., Milwaukee, Wis. Mr. Ferguson will specialize on small tool equipment.

HAROLD D. SMITH, for many years district representative of the Colonial Steel Co., has become district representative of the Cyclops Steel Co., 10 E. 40th St., New York City, in the Connecticut territory.

JOHN D. MILLER, of the Cresson-Morris Co., Philadelphia, Pa., has been appointed a representative of the Gray Iron Institute on the American Society for Testing Materials Committee D-3 on Cast Iron.

E. F. WHITNEY, manager of the Portland office of the General Electric Co. since 1923, has been appointed assistant manager of the east central district, with headquarters at Cleveland, Ohio.

JAMES H. WHITTAKER, who has been for many years with the Brown & Sharpe Mfg. Co., the Pratt & Whitney Co., and the Davenport Machine Tool Co., is now connected with the Cincinnati Planer Co. in the capacity of general superintendent.

EDWARD L. HOLLJES has been appointed sales manager for William Sellers & Co., Inc., Philadelphia, Pa., manufacturer of heavy machine tools and locomotive injectors. Mr. Holljes has been directing the sales of the company for a number of years.

R. D. PHELPS, of the Francis & Nygren Foundry, Chicago, Ill., a member of the Gray Iron Institute Research Committee, has been appointed the official representative for the Institute on the American Foundrymen's Association's Cast Iron Committee.

JOHN C. PANGBORN, vice-president of the Pangborn Corporation, Hagerstown, Md., manufacturer of sand-blast and dust-collecting equipment, sailed for Europe, in company with his family, on the *Olympic*, April 5, for an extended tour on the Continent.

HAROLD S. FALK, vice-president and works manager of the Falk Corporation, Milwaukee, Wis., has been elected a director of the American Foundrymen's Association. Mr. Falk is well known throughout the machinery industries as an active promoter of modern apprenticeship training methods.

CHARLES N. PICKWORTH, who for forty years has been editor of the *Mechanical World* and associated publications, has retired from that position and will devote himself to his consulting practice. His new address is 17 Griffiths Drive, Southport, Manchester, England. Mr. Pickworth is the author of several technical works, including "The Slide-rule."

JOSEPH G. WORKER has been elected vice-president of the Electrical Hoist Manufacturers' Association. Mr. Worker is director of the American Engineering Co., and is in charge of its sales activities. He was recently elected director of the American Fluid Motors Co., of Philadelphia, also of the Affiliated Engineering Companies, Ltd., of Montreal, Canada, and of Juruick Refrigeration, Inc., of New York City. He is a director and former president of the Stoker Manufacturer's Association.

W. E. SLABAUGH was elected a director of the Adamson Machine Co., Akron, Ohio, manufacturer of rubber machinery, molds, general machinery, and castings, at a recent meeting of the board of directors, to succeed the late Alexander Adamson, who was also president and general manager. R. B. KOONTZ, formerly secretary and treasurer, was elected president and general manager. C. L. FENN, formerly assistant treasurer, was elected secretary and treasurer; and L. S. DUDLEY, assistant secretary and assistant treasurer.

E. M. HUMMER, vice-president and general manager of the Defiance Machine Works, Defiance, Ohio, will sail from New York on the S.S. *Aquitania* on May 8 for a two months' trip on the European Continent in the interest of the Defiance Machine Works. Mr. Hummer will visit the representatives and agents of his company, and will also spend several weeks in Russia supervising the installation and starting the operation of a complete plant of Defiance machines for the building of farm wagons, sold to the Soviet Government through the Amtorg Trading Corporation in New York.

* * *

TRADE NOTES

AMERICAN CAN CO. has changed its office address from 120 Broadway to 230 Park Ave., New York City.

PETTY & WHERRY, 50 Church St., New York City, power transmission specialists, have just purchased the business, stock and good will of the COLEMAN POWER TRANSMISSION CO., Brooklyn, N. Y.

PHILADELPHIA GEAR WORKS, Philadelphia, Pa., has just opened a branch sales and engineering office in the Farmers Bank Bldg., Pittsburgh, Pa., for the purpose of giving quicker and better service to customers in the Pittsburgh district.

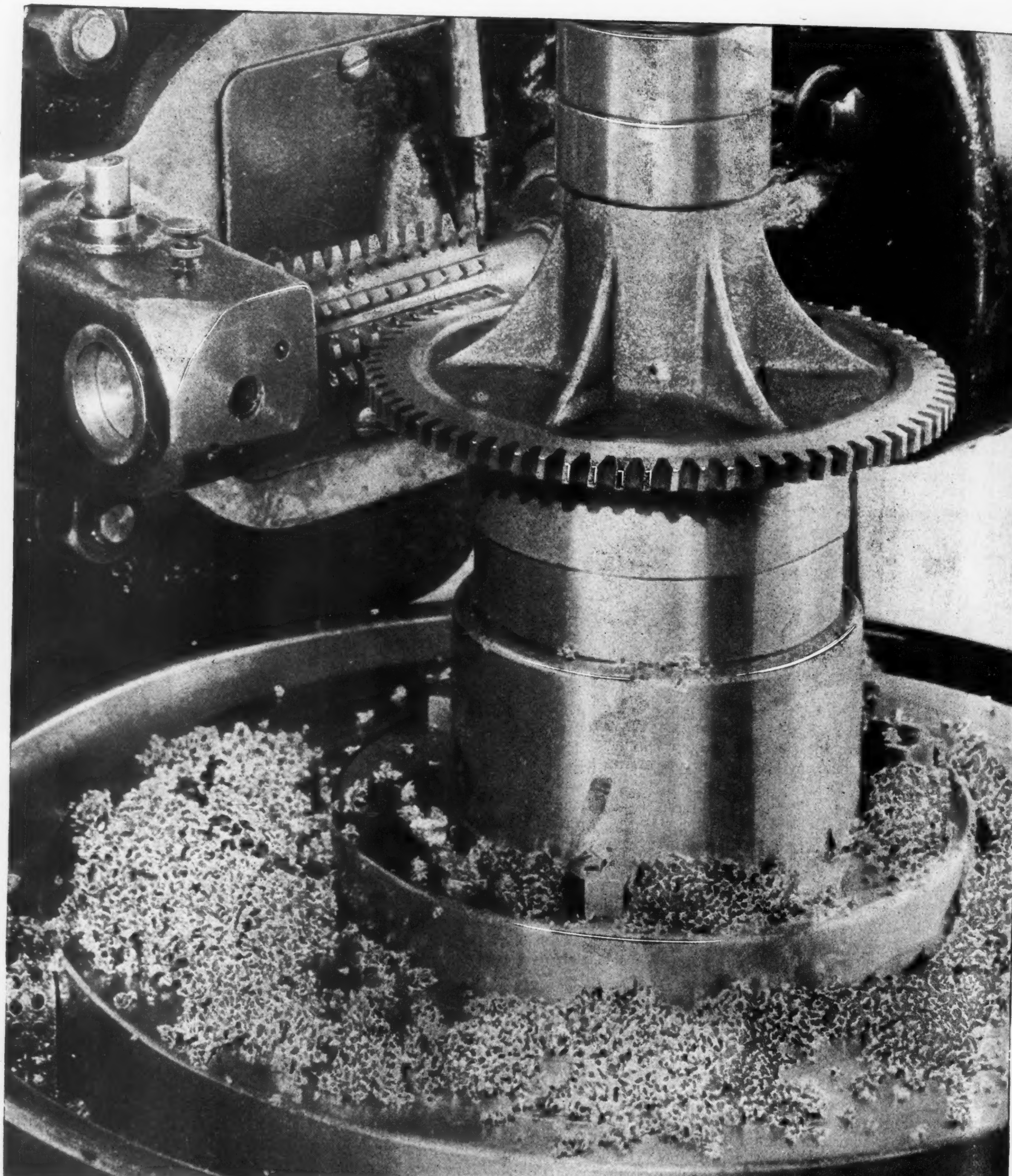
H. B. Kraut,
President Giddings & Lewis
Machine Tool Co.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., builder of high-power precision horizontal boring, drilling, and milling machines, announces that the controlling interest in the company, formerly owned by the Rueping Estate, Inc., and F. J. Rueping of Fond du Lac, has been taken over by H. B. Kraut and his associates. At a recent meeting of the board of directors, Mr. Kraut was elected president and chairman of the board. Mr. Kraut has been associated with the Giddings & Lewis Machine Tool Co. since 1924, when he became vice-president and general manager. He was born in Germany, and is a graduate of the Munich Institute of Technology. He came to the United States in 1906, and two years later became connected with Joseph T. Ryerson & Son, Inc., Chicago, Ill., in charge of the operating end of the machinery department. He also had supervision of foreign sales and traveled extensively abroad during his sixteen years' association with the Ryerson company.

WHITNEY MFG. CO., Hartford, Conn., has moved the Boston office of the company to Room 714, Boston Consolidated Building, 250 Stuart St., Boston, Mass. G. C. Steil is district manager in charge of this office.

MORTON MFG. CO., Muskegon Heights, Mich., has recently purchased the business, good will, and patents of the former DYETT AUTO PRODUCTS CO., Little Falls, N. Y. This includes the line of Dyett keys, which will hereafter be known as Morton "Hi-Pro" keys.

Where ACCUR



CENTRAL ALLOY STEEL CORPORATION, Massillon, Ohio, announces an important program of improvements which will cost approximately $1,000,000. A substantial portion of the expenditure is for expansion plans in connection with the manufacture of the new Krupp Nirosta stainless alloys.

PANGBORN CORPORATION, Hagerstown, Md., has acquired the good will, patterns, records, and drawings of the UNIVERSAL SHOT AND SAND BLAST MFG. CO., Hoboken, N. J. Robert E. Donnelly and Frank C. Weber, sole owners of the latter company, are now associated with the Pangborn Corporation.

AMERICAN ENGINEERING CO., 2435 Araming Ave., Philadelphia, Pa., builder of the Taylor stoker, Lo-Hed hoists, and Juruick refrigerating machines and equipment, has moved the offices of the Stoker Division from 100 Broadway to the American Radiator Building, 40 W. 40th St., New York City.

DANLY MACHINE SPECIALTIES, INC., 2112 S. 52nd Ave., Chicago, Ill., maker of standardized die sets, has recently opened a warehouse and assembly plant at 16 Commercial St., Rochester, N. Y., with A. F. Wallace in charge. Mr. Wallace has been connected with the New York office of the company for a number of years.

GISHOLT MACHINE CO., 1201 East Washington St., Madison, Wis., has appointed A. R. Engler, 6851 Upland Way, Philadelphia, Pa., representative of the company in Philadelphia. Arnold S. Beckman is representative in Buffalo, N. Y., with headquarters at 850 Potomac Ave., and L. G. La Manna is representative in St. Louis, Mo., at 6818 Washington Ave.

UNITED STATES AUTOMATIC BOX MACHINERY CO., 459 Watertown St., Newtonville, Boston, Mass., recently purchased the Mantle universal vise from Mantle & Co. of New York City. The company has also secured the patterns, jigs, and fixtures for the manufacture of this device, and all finished stock and parts on hand, which will make it possible for deliveries to be made in a short time.

S K F INDUSTRIES, INC., 40 E. 34th St., New York City, announces that the Buffalo, Detroit and San Francisco district offices of the company are now located in new headquarters as follows: The Buffalo office has moved from 517 Manufacturers and Traders Bldg. to Main and Genesee Sts.; the Detroit office from 6520 Cass Ave. to 2820 E. Grand Blvd.; the San Francisco office from 115 New Montgomery St. to 221 Eleventh St.

PAULINS TOOL & ENGINEERING CO., 5680 Twelfth St., Detroit, Mich., will in the future be known as the R & M MFG. CO. The company will continue to manufacture the Paulins standard drill jig, as well as precision gages. The president of the concern is E. D. Rummins; secretary-treasurer, J. K. Murray; and manager, R. A. Holt. Rummins and Murray, Inc., of Detroit, are sole distributors of this company's line of jigs and gages.

ROLLER-SMITH CO., 233 Broadway, New York City, announces the appointment of the following district sales agents: J. C. McDougall, Alaska Building, Seattle, Wash., for the states of Washington, Oregon, and Alaska; Carl P. Lohr, 401 National Bank of Commerce Building, St. Louis, Mo., for the St. Louis territory; Jackson Brown, Jr., 701 Kittridge Bldg., Denver, Colo., for the states of Colorado, Utah, Wyoming, and New Mexico.

BARBER-COLMAN CO., Rockford, Ill., has appointed two new agents in California. The Herberts Machinery & Supply Co., 401 E. Third St., Los Angeles, Cal., will have charge of the sale of Barber-Colman milling cutters and hobs and Barber-Colman hobbing machines and hob sharpening machines in Southern California and Arizona. The Herberts-Moore Machinery Co., 140 First St., San Francisco, Cal., will have charge of the sale of these tools in Northern California and Nevada.

MOLINE TOOL CO., Moline, Ill., manufacturer of multiple drilling, boring, reaming, counterboring, tapping, lapping, and special machinery, announces that the directors of the company have re-elected the officers for the new fiscal year. Wilson P. Hunt remains president; Franklin Johnson, vice-president; C. R. Rosborough, secretary and general manager; and E. C. Hunt, treasurer. Wilson P. Hunt formerly also acted as general manager, but was relieved of these duties so that he would be able to devote more of his time to research and inventive work, Mr. Hunt being responsible for the design of the line of machinery for which the Moline Tool Co. is well known.

KELLER MECHANICAL ENGINEERING CORPORATION, 74 Washington St., Brooklyn, N. Y., has arranged to take care of the territories heretofore served by the W. E. Shipley Machinery Co., Henry Prentiss & Co., and Marshall & Huschart Machinery Co. through its own organization. ARTHUR JENNER, who will be located in Philadelphia, will handle eastern Pennsylvania, New Jersey, Maryland, Delaware, and the Metropolitan District of New York. W. L. MACRAE, of Syracuse, will have charge of the remainder of New York state. P. C. RENNO will have headquarters in Chicago, and will be in charge of that territory, including the northern part of Indiana, the western half of Michigan, Illinois, and Wisconsin.

NORTON CO., Worcester, Mass., has started construction on a new abrasive crushing mill and an addition to the grain storage building. These new buildings will greatly enlarge the capacity of the company's Worcester plant. The new crushing mill is a five-story structure, 140 by 60 feet. The addition to the grain storage building will be three stories high, 117 by 54 feet. When the Norton Emery Wheel Co. built its first plant at Barber's Crossing, Worcester, only part of a small wooden building was required. Today the Norton Co.'s Worcester plant has more than 2,225,000 square feet of manufacturing floor space, in addition to factories operated at Bauxite; Niagara Falls; Hamilton and Chippawa, Ontario; Wesseling, Germany; and La Courneuve, France.

LINCOLN ELECTRIC CO., Cleveland, Ohio, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces that in order to meet the rapidly increasing demands for practical instruction in arc welding, the welding school maintained by the company is being greatly expanded. It will probably be necessary to more than double the amount of welding equipment before the end of the current year. At present there is a student waiting list of constantly increasing length, and it is to take care of the urgent demand by manufacturers for more skilled arc welders that the present expansion is being made. The Lincoln welding school is under the direct supervision of Arthur E. Madson, a man who is not only thoroughly familiar with his subject, but who is also able to impart his knowledge to others.

CLEVELAND STONE CO., Cleveland, Ohio, and the OHIO QUARRIES CO. have merged their interests, and will hereafter operate as one company under the name of the CLEVELAND QUARRIES CO. The officers of the new company are as follows: Chairman of the board, W. A. C. Smith, president of the Ohio Quarries Co.; president, H. W. Caldwell, president of the Cleveland Stone Co.; executive vice-president, F. D. Kellogg, vice-president and treasurer of the Ohio Quarries Co.; vice-president and treasurer, J. R. Miller, vice-president and treasurer of the Cleveland Stone Co. The Sterling Grinding Wheel Co., which has been under the control of the Cleveland Stone Co. for some years, will be operated as the Abrasive Division of the Cleveland Quarries Co. The executive direction of the Sterling Grinding Wheel Co. will continue under H. W. Caldwell as president.

OBITUARY

CHARLES E. CARPENTER, president of the E. F. Houghton & Co., Philadelphia, Pa., died of heart disease at Miami Beach, Fla., April 6, aged sixty-seven years. Mr. Carpenter was known as a speaker and writer on economic subjects.

More than half a million dollars was paid in pensions by the General Electric Co. during 1928. Since the inception of the pension plan, a total of $2,129,470 has been paid out in pensions. At the end of 1928 there were 877 pensioners. The average age of those receiving pensions is 68.7 years. The average active service of these men was 28.35 years, and the average annual pension, $730.

* * *

In an effort to reduce the country's annual accident death total, said to be fully 100,000, thirteen weekly programs, entitled "The Universal Safety Series," were inaugurated by the National Broadcasting Co. in conjunction with the National Safety Council, beginning at 7:30 p.m., April 20. The first address, entitled "Safety as a Factor in Industry," was delivered by Charles M. Schwab.

COMING EVENTS

MAY 6-8—Annual spring convention of the American Management Association at the Hotel Pennsylvania, New York City. For further information, address the American Management Association, 20 Vesey St., New York City.

MAY 6-11—Twelfth exposition of the Chemical Industries at the Grand Central Palace, New York City. For further information, address Chemical Industries Exposition Office, Grand Central Palace, New York City.

MAY 13-15—Meeting of the American Society of Mechanical Engineers at Rochester, N. Y. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 16-18—Annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Statler, Cleveland, Ohio. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

JUNE 19-21—International Management Congress to be held at Paris, France. A large delegation from America will attend. For further information, address the American Management Association, 20 Vesey St., New York City.

JUNE 24-28—Annual meeting of the American Society for Testing Materials at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. C. L. Warwick, Secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

JUNE 25-28—Summer meeting of the Society of Automotive Engineers at Saranac Inn, Saranac Lake, N. Y. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

JULY 1-4—Summer meeting of the American Society of Mechanical Engineers at Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 26-28—Aeronautic meeting of the Society of Automotive Engineers at the Hollenden Hotel, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the American Welding Society in Cleveland, Ohio. M. M. Kelly, secretary, 33 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. W. M. Corse, secretary, 810 Eighteenth St., N.W., Washington, D. C.

SEPTEMBER 9-12—Fall meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. H. Foster Bain, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland. Ohio.

SEPTEMBER 9-13—National Metal Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division, American Institute of Mining and Metallurgical Engineers; and American Society for Steel Treating.

SEPTEMBER 9-13—Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 11-13—Fall meeting of the Iron and Steel Division, American Society of Mechanical Engineers in Cleveland, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 30-OCTOBER 4—Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, Provident Bank Building, Cincinnati, Ohio.

OCTOBER 2-4—Production meeting of the Society of Automotive Engineers to be held at Hotel Cleveland, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SOCIETIES, SCHOOLS AND COLLEGES

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass. Bulletin containing abstracts of scientific and technical publications.

NEW BOOKS AND PAMPHLETS

SEASONING, HANDLING, AND CARE OF LUMBER. 74 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as the sixth report of a series on the marketing and use of lumber. Price, 20 cents.

THE FOREMAN'S PART IN SAFETY. 16 pages, 5 1/4 by 7 1/2 inches. Distributed by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City, as Industrial Safety Pamphlet No. 4.

PRACTICAL RAILWAY PAINTING AND LACQUERING. By H. Hengeveld, C. P. Disney, and William J. Miskella. 242 pages, 6 by 9 inches. Distributed by the Simmons-Boardman Publishing Co., 30 Church St., New York City. Price, $3.50.

This is the fourth volume in a series on practical finishing, the first three volumes having dealt with color, automotive lacquering, and japanning and enameling. The present work is a handbook especially intended for railroad men.

X-RAYS IN INDUSTRY. 60 pages, 5½ by 8½ inches. Distributed by the Eastman Kodak Co., Rochester, N. Y.

This booklet has been prepared to suggest some of the industrial applications of X-rays in inspecting the internal construction of opaque materials. It does not attempt to go into a scientific discussion of the subject, but rather states briefly how X-rays are produced, describes the necessary apparatus, and presents some rules for the proper exposure and manipulation of radiographic films. A bibliography of books and articles on this general subject is appended.

PRODUCTION PLANNING. By John W. Hallock. 172 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.

In view of the fact that the organization and direction of production is a technical engineering subject, the author of this book has adopted the same scientific and mathematical treatment accorded to other problems of engineering design. He has aimed to show how to use mathematical relationships and computations in answering practical questions and solving every-day problems of production. Every step in planning production and establishing complete control is brought down to definite formulas and procedures. The text is divided into thirteen chapters headed as follows: The Function of Planning; Estimating for Production; Determination of Machine Capacities; Computing Process Times; Economies in the Use of Jigs and Fixtures; Material Handling in Controlled Production: Economies in Material and Tool Control; Standard Instructions as Affecting Process Times; Economies of Production Scheduling; Reduction of Process Times; Planned Control; Coordinating Marketing and Production; The Function of Production Control.

FUNDAMENTALS OF FLUID DYNAMICS FOR AIRCRAFT DESIGNERS. By Max M. Munk. 198 pages, 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $8.

The author of this book is a recognized authority on the subject of aerodynamics, having formerly been in charge of aerodynamic research for the National Advisory Committee for Aeronautics and at the Goettingen Aerodynamic Institute. During the last twelve years he has made many experiments to test various theories, and a considerable number of mathematical formulas have been developed by him to explain phenomena observed in research and flight tests. The results have appeared in more than seventy-five publications. The present work contains the most useful portions of that extensive material, brought together in one coordinate volume, together with important data that developed later. Some of the earlier formulas have been simplified, and particular attention is given to the applications of the formulas in the present treatment rather than to their derivation. The book contains nine chapters covering the following subjects: The Classical Principles of Hydrodynamics; The Aerodynamic Forces on Airship Hulls; The Potential Flow of the Straight Line; Theory of the Wing Section; Theory of the Complete Wing; Propeller Theory; Advanced Subjects; Air Friction; and Measured Air Forces.

NEW CATALOGUES AND CIRCULARS

MILLING CUTTERS. National Twist Drill & Tool Co., Detroit, Mich. Circular covering "Parabolic" deep-counterbore shell end-mills.

MACHINE KEYS. Morton Mfg. Co., Muskegon Heights, Mich. Bulletin 25, containing dimensions and price list of Morton "Hi-Pro" keys.

ROLLER BEARINGS. Hyatt Roller Bearing Co., Newark, N. J. Circular illustrating the use of Hyatt roller bearings in farm machinery.

ELECTRIC FANS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Bulletins 17-2 to 17-6, illustrating and describing different types of electric fans.

ELECTRIC WELDING EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GED-276, giving specifications for welding steel buildings by electricity.

TWIST DRILLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Circular illustrating Morse twist drills, and outlining the steps taken to insure accuracy and uniformity.

MAGNETIC SEPARATION EQUIPMENT. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 80, treating of magnetic separation equipment for the concentration of ores and minerals.

STEEL TRANSMISSION CHAIN. American Manganese Steel Co., Chicago Heights, Ill. Post card advertising the savings effected by the use of "Amsco" conveying and transmission chains.

ELECTRIC FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2121, containing data on Arktite circuit-breaking plugs and receptacles. Bulletin 2129, on Vaporproof Industrial fixtures.

PIPE CLEANING TOOLS. Stow Mfg. Co., Inc., Binghamton, N. Y. Bulletin illustrating the Stow "Sani" line of pipe cleaning tools for removing obstructions from distant points in all types of piping.

TURRET LATHES. Jones & Lamson Machine Co., Springfield, Vt. Bulletin illustrating a job performed on a 4-inch J & L bar lathe. The various steps in the operation are illustrated, and the time for each step is given.

MACHINE TOOL EQUIPMENT, CRANES, AND SUPPLIES. Manning, Maxwell & Moore, Inc., 100 E. 42nd St., New York City. Pamphlet entitled "The M.M.M. Family Tree," outlining the various activities of the organization.

DRILL JIGS. R & M Mfg. Co., 5680 Twelfth St., Detroit, Mich. Circular illustrating and describing the construction of the Paulins standard drill jig, which is furnished either with a standard or a special head.

AIR FILTERS. Midwest Air Filters, Inc., Bradford, Pa. Pamphlet entitled "Man's Conquest of the Air," containing a technical discussion of the subject of dust elimination by means of the centrifugal air cleaning principle.

FLEXIBLE COUPLINGS. W. H. Nicholson & Co., 112 Oregon St., Wilkes-Barre, Pa. Bulletin 329, descriptive of the construction and operation of Nicholson flexible couplings, and showing applications in different classes of service.

MANGANESE ALLOYS. Southern Manganese Steel Co., 6600 Ridge Ave., St. Louis, Mo. Post Card advertising the use of Fahralloy for disks, transmission chains, sprocket wheels, apron conveyors, and other parts subjected to heat and corrosion.

GRINDING WHEELS AND MACHINES. Norton Co., Worcester, Mass. Booklet entitled "Complete Equipment for High-speed Snagging," illustrating and briefly describing the Norton line of grinding wheels and grinding machines for high-speed snagging.

RIVETERS. Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. Bulletin R-205-A, illustrating and describing in detail the construction of Hanna yoke riveters. The various types of riveters are shown, as well as applications on different classes of work.

PORTABLE POWER UNITS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Circular 14-1000, illustrating and describing Century portable power units built in 3, 5, and 7½ horsepower sizes, and made to operate on power delivered by any power company.

SERVICE SHOP EQUIPMENT. Hobart Bros. Co., Box DM93, Troy, Ohio. Circular illustrating the complete line of HB service shop equipment, including electrical test equipment, arc-welding machines, motor buffers and grinders, air compressors, paint spray outfits, etc.

TEMPERATURE CONTROL EQUIPMENT. Bristol Co., Waterbury, Conn. Bulletin 367, on the subject of temperature control as applied to chromium plating tanks. Several installations of Bristol automatic temperature control equipment on chromium plating tanks are illustrated.

TRANSFORMER OIL. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 162, on Wagner transformer oil, containing complete specifications for this oil, and discussing the purposes, properties, methods of testing, precautions to be observed when handling and storing, etc.

SPEED REDUCERS. W. A. Jones Foundry & Machine Co., 4409 W. Roosevelt Road, Chicago, Ill. General catalogue No. 42 entitled "The Jones Blue Book," containing nearly 500 pages, listing the speed reducers, cut gears, pulleys, and general power transmission machinery made by this company.

ELECTRIC FURNACES. Ajax Electrothermic Corporation, Division of the Ajax Metal Co., Trenton, N. J. Bulletin 4a, illustrating and describing the Ajax-Northrup 3 KV-A converter and furnace, which is especially suitable for college and commercial research laboratories, dental alloy melting, and jewelers' work.

PROTECTIVE COATINGS. Quigley Furnace Specialties Co., Inc., 26 Cortlandt St., New York City. Pamphlet entitled "Protect Your Plant and Equipment," outlining the characteristics and advantages of Quigley Triple A solutions—protective coatings to prevent corrosion of iron, steel, galvanized, and plated surfaces.

PORTABLE PNEUMATIC TOOLS. Rotor Air Tool Co., Cleveland, Ohio. Catalogue 6, containing data on Rotor portable pneumatic tools. The bulletin gives examples of increases in production that have been made by the use of these tools, and describes the features of construction of the various types. Complete specifications are included.

ELECTRIC WELDING MACHINES. Taylor-Winfield Corporation, Warren Ohio. Loose-leaf catalogue containing bulletins illustrating and describing the different types of electric spot-welding and butt-welding machines made by this company. Complete specifications of the various types are given. The bulletins are arranged in a folder with a tab on which is printed the subject of the catalog, for convenient filing and reference.

SWING FRAME GRINDER. Kinney Iron Works, Santa Fe Ave. and 28th St., Los Angeles, Calif. Circular illustrating and describing the new Kinney ball-bearing swing-frame grinder, which has been designed especially with simplicity and ruggedness in view, so as to withstand severe usage at minimum upkeep cost. The wheel runs at right angles to the frame so that the operator can see the work at all times; the danger of the wheel breaking is also minimized.

STEEL. Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa. Bulletin containing standard specifications for steel for bridges and buildings; locomotives and cars; boilers and boiler rivets; commercial and forging bars; reinforcement bars; forgings; railway and industrial wheels; and axles and shafts. The standards given are those adopted by the Association of American Steel Manufacturers, the American Society for Testing Materials, the American Society of Mechanical Engineers, and the Carnegie Steel Co.

PRESSES. V & O Press Co., Hudson, N. Y. Catalogue 29, illustrating and describing the construction features of the V & O line of power presses. Specifications are given for inclinable open-back presses, bench presses, standard punch presses, V & O arch presses, horning and wiring presses, double- and single-crank straight-sided presses, foot presses, reducing presses, and threading and trimming machines. The catalogue also describes the King pressure toggle, which is a permanent attachment that may be applied to any make of single-action press.

BUFFING WHEELS. Divine Brothers Co., Utica, N. Y. Catalogue entitled "Buffing Wheels," containing complete descriptions and specifications of full disk, sewed pieced, and special buffing wheels. In addition to listing the different kinds of buffs made by the company, the catalogue contains a great deal of general information on buffs, describes the materials from which they are made, and outlines the methods by which they are produced. The uses and applications of different kinds of buffs are also outlined.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-98A, descriptive of type BSR adjustable-varying-speed motors. Bulletin GEA-961A, illustrating and describing helicoil (sheath wire) resistor units for cable-reel motors. Circular GEA-991, containing detailed information on insulating material for railway and industrial-haulage apparatus. Circular GEA-1101, descriptive of induction, motor-generator sets for motion-picture projection. Bulletin GEA-1102, treating of G-E electric heating equipment for hot-galvanizing tanks.

MACHINE TOOL EQUIPMENT. Consolidated Machine Tool Corporation of America, Rochester, N. Y. Catalogue illustrating machine tool equipment for automotive and other high-production shops. Among the machines shown are Newton milling machines, Colburn drilling machines, Newton crank planers, Betts slotters, Rochester gear tooth rounding machines, "Modern" small tools, Betts heavy-duty borers and millers, Betts planers, Hilles & Jones structural and boiler shop equipment, etc. The examples shown have been chosen from among a great many as being of the widest interest. Close-ups of actual operations and production data are given in a number of cases.

PRECISION BORING EQUIPMENT. Societe Genevoise d' Instruments de Physique, Geneva, Switzerland. (United States representative, R. Y. Ferner Co., Investment Bldg., Washington, D. C.) Catalogue entitled "Modern Precision Boring," illustrating the application of the Swiss jig borer to various problems of laying out, drilling, and boring holes in jigs, fixtures, dies, and molds, and the direct production of parts in the manufacture of special machinery. The book contains numerous illustrations of jig borers and of jobs done on them in both European and American shops. The dimensions of holes, limits of accuracy, and reduced time of doing the work are given in connection with many of the examples.

BRITISH AND GERMAN MACHINERY TRADE

During 1927, the last year for which complete statistics are available, Great Britain imported industrial machinery to a value of approximately $50,000,000. The imports of 1926 were valued at approximately $40,000,000. Of the imports in 1927, those from the United States constituted over 50 per cent of the total and those from Germany about 20 per cent. In 1928, machine tools were imported to a value of $7,000,000, as compared with less than $6,000,000 in 1927. Of the machine tools imported, 44 per cent of the tonnage and 62 per cent of the value came from the United States. Forty-six per cent of the tonnage and 31 per cent of the value came from Germany. These figures indicate the predominance of the higher class American machine tools in British imports.

The imports of industrial machinery into Germany during 1928 were valued at approximately $26,000,000, an increase of more than $3,000,000 over 1927. Of these imports, metal-working machinery was valued at slightly over $3,500,000, an increase of close to $500,000 over 1927. The United States led as the main source of the German imports of metal-working machinery, furnishing more than one-half the total, followed by Switzerland, Great Britain, and Belgium. Sweden led in supplying the largest volume of woodworking machinery, with the United States second, and Norway third.

The exports of industrial machinery from Germany during 1928 were valued at $230,000,000, of which about $35,000,000 represented metal-working machinery. The exports exceeded those of 1927 by $45,000,000.

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THE VALUE OF COMPARATIVE DATA

In presenting engineering information, comparative data is always of interest and value. Figures, particularly large figures, that are given by themselves without any comparison, are of value only to a few to whom the subject is so familiar that they can make the comparison immediately in their own minds. For example, the statement that a certain machine produces 1500 pieces a day does not mean so much by itself, but when it is added that this is nearly twice the production of the best previous method, it immediately becomes clear that the new development is of the greatest importance. A new suspension bridge is being built across the Hudson River between New York and New Jersey which will have a span of 3500 feet. This statement in itself implies a span of great magnitude, but the real significance of this engineering enterprise becomes evident only if we are reminded that this is twice the length of any suspension bridge built up to the present time.